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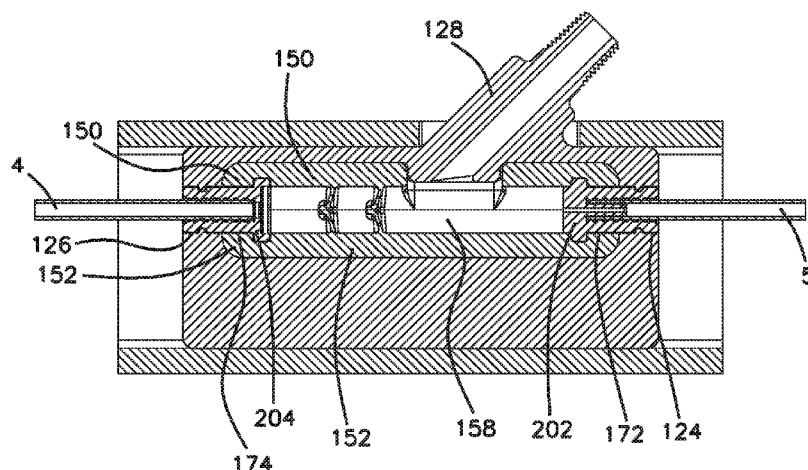
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(54) Title: CABLE BLOWING SYSTEM

FIG. 7



(57) Abstract: A cable blowing system and related methods for blowing a cable through a conduit is disclosed. The cable blowing system can include a compressed gas source, a pulse generator, and a cable blowing assembly. The cable blowing assembly can define an internal chamber and a compressed gas inlet that places the internal chamber in fluid communication with the compressed gas source. A sealing structure can be provided in the internal chamber to act as a check valve to prevent compressed gas delivered to the conduit from migrating back into the internal chamber. The pulse generator is disposed between the compressed gas source and the cable blowing assembly and is configured to alternately place the internal chamber in fluid communication with the compressed gas source and to isolate the internal chamber from the compressed gas source.



CABLE BLOWING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is being filed on May 5, 2016 as a PCT International Patent Application and claims the benefit of U.S. Patent Application Serial No. 62/158,815, filed on May 8, 2015, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND

[0002] The demand for the installation of fiber optic telecommunications cables within existing building structures, for example multiple dwelling units (MDU's), has recently increased. However, providing for such installations can be challenging using conventional optical fiber installation techniques and standard optical fiber cable sizes. For example, pulling long riser cables in buildings with congested cable pathways can be extremely difficult and time consuming. At the concentration points of the cables, for example, a basement, many times the fiber density is too high to provide for adequate organization and can also present a fire hazard. Due to this congestion, the number of cable splicing locations increases, especially where congestion prevents the use of pre-connectorized cables. This further increases costs and also increases the skill level requirement for field installers. Additionally, cable blowing installation techniques used for conventionally sized fiber optic cables can be inefficient or suboptimal when applied to fiber optic cables of a smaller dimension and of the type that may be more suitable for installation in a pre-existing building structure with limited available space.

SUMMARY

[0003] In one aspect of the disclosure, a cable blowing assembly for blowing a cable through a conduit is disclosed. The cable blowing assembly can include a first housing part and a second housing part being mateable with the first housing part. The first housing part can have a compressed gas inlet. A first internal chamber part can be provided that is at least partially received within the first housing part, wherein the first internal chamber part defines a first cavity and an opening between the first cavity and the compressed gas inlet. A second internal chamber part can be provided that is at least partially received within in the second housing part, wherein the first and second cavities

form an internal chamber when the first and second internal chamber parts are mated together. A first flange piece can be provided that has a first aperture through which the cable can be fed into the internal chamber, wherein the first flange piece is mountable between the first and second internal chamber parts. A second flange piece can be provided that has a second aperture through which the cable can be fed out of the internal chamber, wherein the second flange piece is mountable between the first and second internal chamber parts, and wherein the second aperture has a dimension that is larger than a corresponding dimension of the first aperture.

[0004] A cable blowing system for blowing a cable through a conduit is disclosed. The cable blowing system can include a compressed gas source, a pulse generator, and a cable blowing assembly. The cable blowing assembly can be structured as described above. The cable blowing assembly can define an internal chamber and a compressed gas inlet that places the internal chamber in fluid communication with the compressed gas source, wherein the cable blowing assembly includes at least one sealing structure disposed within the internal chamber and located between the compressed gas inlet and the conduit. The at least one sealing structure is in an open position when the internal chamber is in fluid communication with the compressed gas source and is in a closed position when the internal chamber is isolated from the compressed gas source. The pulse generator is disposed between the compressed gas source and the cable blowing assembly and is configured to alternately place the internal chamber in fluid communication with the compressed gas source and to isolate the internal chamber from the compressed gas source.

[0005] A method of installing a cable in a conduit is also disclosed. The method can include the steps of: inserting a cable through a first aperture of a first flange piece; inserting the cable through a second aperture of the second flange piece, wherein the second aperture has a dimension that is larger than a corresponding dimension of the first aperture; connecting the second flange piece to the conduit; inserting the first and second flange pieces into a first internal chamber part; mating a second internal chamber part to the first internal chamber part to form an internal chamber between the first and second internal chamber parts such that the cable enters the internal chamber through the first flange piece and exits the internal chamber through the second flange piece and such that a seal structure is formed about the cable; and providing compressed gas, such as

compressed air or nitrogen, to the internal chamber in pulsed cycles to cause the seal structure to open and the cable to feed through the internal chamber and into the conduit.

[0006] A variety of additional aspects will be set forth in the description that follows. These aspects can relate to individual features and to combinations of features. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the broad concepts upon which the embodiments disclosed herein are based.

DRAWINGS

[0007] Figure 1 is a schematic view of a cable blowing system having exemplary features of aspects in accordance with the principles of the present disclosure, wherein the cable blowing system is configured to blow cable into a first conduit from a second conduit.

[0008] Figure 2 is a schematic view of the cable blowing system shown in Figure 1, wherein the cable blowing system is configured to blow cable into a first conduit from a packaged coreless wound cable.

[0009] Figure 3 is a perspective view of a cable blowing assembly of the cable blowing system shown in Figure 1.

[0010] Figure 4 is a front view of the cable blowing assembly shown in Figure 3.

[0011] Figure 5 is a top view of the cable blowing assembly shown in Figure 3.

[0012] Figure 6 is a first end view of the cable blowing assembly shown in Figure 3.

[0013] Figure 7 is a cross-sectional view of the cable blowing assembly shown in Figure 3, taken along the line 7-7 in Figure 6.

[0014] Figure 8 is a cross-sectional view of the cable blowing assembly shown in Figure 3, taken along the line 8-8 in Figure 6.

[0015] Figure 9 is a perspective exploded view of the cable blowing assembly shown in Figure 3.

[0016] Figure 10 is a top perspective view of a first housing part associated with the cable blowing assembly shown in Figure 3.

[0017] Figure 11 is a bottom perspective view of the first housing part shown in Figure 10.

[0018] Figure 12 is a first side view of the first housing part shown in Figure 10.

[0019] Figure 13 is a bottom view of the first housing part shown in Figure 10.

[0020] Figure 14 is a first end view of the first housing part shown in Figure 10.

[0021] Figure 15 is a second end view of the first housing part shown in Figure 10.

[0022] Figure 16 is a top view of the first housing part shown in Figure 10.

[0023] Figure 17 is a cross-sectional view of the first housing part shown in Figure 10, taken along the line 17-17 in Figure 16.

[0024] Figure 18 is a top perspective view of a second housing part associated with the cable blowing assembly shown in Figure 3.

[0025] Figure 19 is a side view of the second housing part shown in Figure 18.

[0026] Figure 20 is a bottom view of the second housing part shown in Figure 18.

[0027] Figure 21 is a first end view of the second housing part shown in Figure 18.

[0028] Figure 22 is a top view of the second housing part shown in Figure 18.

[0029] Figure 23 is a cross-sectional view of the second housing part shown in Figure 18, taken along the line 23-23 in Figure 22.

[0030] Figure 24 is a perspective view of a clamp structure associated with the cable blowing assembly shown in Figure 3.

[0031] Figure 25 is a top view of the clamp structure shown in Figure 24.

[0032] Figure 26 is a front view of the clamp structure shown in Figure 24.

[0033] Figure 27 is a first end view of the clamp structure shown in Figure 24.

[0034] Figure 28 is a bottom perspective view of a first internal chamber part associated with the cable blowing assembly shown in Figure 3.

[0035] Figure 29 is a top view of the first internal chamber part shown in Figure 28.

[0036] Figure 30 is a side view of the first internal chamber part shown in Figure 28.

[0037] Figure 31 is a bottom view of the first internal chamber part shown in Figure 28.

[0038] Figure 32 is a first end view of the first internal chamber part shown in Figure 28.

[0039] Figure 33 is a second end view of the first internal chamber part shown in Figure 28.

[0040] Figure 34 is a bottom perspective view of a second internal chamber part associated with the cable blowing assembly shown in Figure 3.

[0041] Figure 35 is a top view of the second internal chamber part shown in Figure 34.

[0042] Figure 36 is a bottom view of the second internal chamber part shown in Figure 34.

[0043] Figure 37 is a side view of the second internal chamber part shown in Figure 34.

[0044] Figure 38 is a first end view of the second internal chamber part shown in Figure 34.

[0045] Figure 39 is a second end view of the second internal chamber part shown in Figure 34.

[0046] Figure 40 is a side view of a first flange piece associated with the cable blowing assembly shown in Figure 3.

[0047] Figure 41 is a first end view of the first flange piece shown in Figure 40.

[0048] Figure 42 is a second end view of the first flange piece shown in Figure 40.

[0049] Figure 43 is a side view of a second flange piece associated with the cable blowing assembly shown in Figure 3.

[0050] Figure 44 is a first end view of the second flange piece shown in Figure 40.

[0051] Figure 45 is a second end view of the second flange piece shown in Figure 40.

[0052] Figure 46 is a perspective view of the first and second flange pieces and conduits prior to connection between a first connector part and a second connector part that hold the flange pieces together.

[0053] Figure 47 is a perspective view of the first and second connector parts being connected to secure the flange pieces together.

DETAILED DESCRIPTION

[0054] Reference will now be made in detail to the exemplary aspects of the present disclosure that are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like structure.

[0055] Referring to Figures 1 and 2, a cable blowing system 1 is shown. The cable blowing system 1 is particularly suited for blowing an optical fiber cable 2 through a conduit 4 from another conduit 5, as shown in Figure 1, or from a wound or spooled cable source 7, as shown in Figure 2. One example of a suitable cable source is a packaged coreless wound cable shown and described in US Patent Application 62/094,656, filed on December 19, 2014 and entitled FIBER DISTRIBUTION SYSTEM AND CORELESS WOUND COIL. The entirety of US 62/094,656 is incorporated by reference herein. In one example, the conduits 4 and/or 5 have an inner diameter of about 3 millimeters (mm) and an outer diameter of about 5 mm. In one example, the cable 2 is a microfiber cable having an outer diameter of about 900 microns.

[0056] The cable blowing system 1 can additionally include a compressed gas source 6, for example an air compression system 6. The compressed gas source 6 can include other types of gas compression systems or can more simply include a vessel with a pressurized gas stored within, for example a tank holding compressed dry nitrogen. The cable blowing system 1 can also include a cable blowing assembly 100, and a conduit assembly 8 extending between the gas/air compression system 6 and the cable blowing assembly 100. The cable blowing system 1, shown in more detail at Figures 3-9, may also include an air pulse generator 10 in fluid communication with the gas/air compression system 6 and the cable blowing assembly 100.

[0057] In one aspect, the cable blowing assembly 100 includes a first housing part 102 defining a first cavity 104 and a second housing part 106 defining a second cavity 108. The first housing part 102 is shown in greater detail at Figures 10-17 and the second housing part 106 is shown in greater detail at Figures 18-23. The first housing part 102 has a face 102d that is configured to mate with a face 106d of the second housing part 106

such that the first cavity 104 and second cavity 108 form an internal cavity 110. As shown, the first housing part 102 is provided with a plurality of recesses 112 and the second housing part 106 is provided with a plurality of pins 114 configured to be received into the recesses 112. Together, the recesses 112 and pins 114 ensure that the first and second housing parts 102, 106 are properly aligned when mated together. It should be appreciated that all or some of the recesses 112 could be provided on the second housing part 106 and that all or some of the pins 114 could be provided on the first housing part 102. Other types of alignment features may be utilized as well without departing from the concepts presented herein.

[0058] The first housing part 102 is further provided with a semi-circular opening 116 at a first end 102a and a semi-circular opening 118 at a second end 102b, wherein the openings 116, 118 extend into the internal cavity 110. Similarly, the second housing part 106 is provided with semi-circular openings 120, 122 at respective first and second ends 106a, 106b. When the first and second housing parts 102, 106 are mated together, the openings 116, 120 form a circular opening 124 into the internal cavity 110 while openings 118, 122 form a circular opening 126 into the internal cavity 110. It is noted that openings 116, 118, 120, 122 may be provided with other shapes and configurations as well without departing from the concepts presented herein. The openings 124, 126 allow for flange elements 202, 204, discussed in more detail below, to be received into the internal cavity 110. Each of the openings 116, 118, 120, 122 is also shown as being provided with a raised rib structure 116a, 118a, 120a, 122a which are received in corresponding grooves 206, 208 of the flange elements 202, 204 are locked into a fixed position when the first and second housing parts 102, 106 are mated together.

[0059] The first housing part 102 also includes a compressed gas inlet port 128 extending from a first end 130 to a second end 132. As shown, the first end 130 is provided with an attachment feature 134 such that the conduit 8 can be attached to the gas inlet port 128 either directly or via a quick-connect or other type of coupling. As shown, the attachment feature 134 is configured as threads on the inlet 128. The second end 132 extends into the cavity 104 such that gas/air from the gas/air compression system 6 can be delivered to the internal cavity 110 via the conduit 8. The gas inlet port 128 is also shown as being presented at an oblique angle to the longitudinal axis of the first housing part 102 such that the first end 130 is closer to the first end 102a of the first housing part 102 than is the second end 132. Correspondingly, the second end 132 is closer to the second end 102b of

the first housing part 102 than is the first end 130. This configuration allows the gas inlet port 128 to introduce compressed gas into the internal cavity 110 in a direction that is more aligned with the desired blowing direction for the optical fiber 2 through the internal cavity 110. The compressed gas can be, for example, compressed air, compressed carbon dioxide, compressed nitrogen gas, and/or compressed dry nitrogen gas.

[0060] The first and second housing parts 102, 106 can be held in the mated position by a variety of means. In the exemplary embodiment shown, a clamp structure 140 is provided for this purpose. The clamp structure 140 is shown in greater detail at Figures 24-27. As shown, the clamp structure 140 is an elongate member with a first side 142, a second side 144, and a third side 146. As configured, the clamp structure 140 can be slid over the mated housing parts 102, 106 to clamp the housing parts together. Once the clamp structure 140 is mounted, the first side 142 is adjacent a top side 102c of the first housing part 102, the second side 144 is adjacent the sides of both the first and second housing parts 102, 106, and the third side 146 is adjacent a bottom side 104c of the second housing part 102. The first side 142 is shown as being provided with a recessed area 148 which allows for the clamp structure 140 to be slid onto the housing parts 102, 106 such that the gas inlet port 128 is received in the recessed area 148 and does not interfere with the clamp structure 140.

[0061] With reference to Figures 7 and 9, it can be seen that a first internal chamber part 150 and a mating second internal chamber part 152 are disposed within the internal cavity 110. The first internal chamber part 150 is shown in greater detail at Figures 28-33 while the second internal chamber part is shown in greater detail at Figures 34-39. As configured, the first internal chamber part 150 is received and retained within the cavity 104 of the first housing part 102 and the second internal chamber part 152 is received and retained within the cavity 108 of the second housing part 106. In one aspect, the first and second housing parts 102, 106 are formed from a generally rigid material, such as a metal material or a relatively hard plastic while the first and second internal chambers 150, 152 are formed from a relatively soft, pliable, or flexible material, such as a silicone rubber or neoprene. The previously discussed clamp structure 140 may also be provided as a relatively rigid material.

[0062] In one aspect, the first internal chamber part 150 defines a first end 150a, a second end 150b, and a top side 150c, and a mating face 150d. The first internal chamber part

150 further defines an internal cavity 154 and an aperture 155 extending from the top side 150c to the cavity 154. The aperture 155 allows compressed gas from gas inlet 128 to pass through the chamber part 150 and into the cavity 154. The second internal chamber part 152 also defines a first end 152a, a second end 152b, a bottom side 152c, and a mating face 152d. The second internal chamber part 152 also defines an internal cavity 156. When the first and second internal chamber parts 150, 152 are respectively mounted into the first and second housing parts 102, 106 and when the first and second housing parts 102, 106 are mated together, the first and second internal chamber parts 150, 152 are mated together at faces 150d, 152d to form an internal chamber 158.

[0063] To optimize a seal between the faces 150d, 152d that will withstand pressure from the gas/air compression system 6, the first internal chamber part 150 is shown as being provided with a pair of recesses 160 running along the length of the first internal chamber part 150 that engage with corresponding raised ribs 162 on the second internal chamber part 152. This configuration further allows the gas/air pressure within the internal chamber 158 to aid in forming the seal between the parts 150, 152 as the gas/air pressure will force the ribs 162 laterally against the recesses 162 which causes a seal to form. As such, increasing gas/air pressure within the internal chamber 158 increases the sealing force between the parts 150, 152. Because of this configuration, it is not required that the clamp structure 140 provide significant compression force onto the housing parts 102, 106 in order to ensure a seal between the parts 150, 152.

[0064] The first internal chamber part 150 is further provided with a semi-circular opening 164 at the first end 150a and a semi-circular opening 166 at the second end 150b, wherein the openings 164, 166 extend into the internal chamber 158. Similarly, the second internal chamber part 152 is provided with semi-circular openings 168, 170 at respective first and second ends 152a, 152b. When the first and second internal chamber part 150, 152 are mated together, the openings 164, 168 form a circular opening 172 into the internal chamber 158 while openings 166, 170 form a circular opening 174 into the internal chamber 158. It is noted that openings 164, 166, 168, 170 may be provided with other shapes and configurations as well without departing from the concepts presented herein. The openings 172, 174 allow for flange elements 202, 204, discussed in more detail below, to be received into the internal cavity 150. Each of the openings 164, 166, 168, 170 is also shown as being provided with an enlarged recessed portion 164a, 166a, 168a, 170a which receive heads 210, 212 of the flange elements 202, 204 in a sealing fashion

and ensure that the flange elements 202, 204 are locked into a fixed position when the first and second internal chamber parts 150, 152 are mated together.

[0065] Each of the first and second chamber parts 150, 152 are also provided with a pair of respective half seal members 176, 178. When the first and second internal chamber parts 150, 152 are mated together, the half seal members 176 engage with the half seal members 178 to form a seal structure around the cable 2. In one embodiment, the seal members 176, 178 are disposed at an oblique angle with respect to the longitudinal axis or length of the chamber parts 150, 152 (i.e. distal end of seal members 176, 178 angle towards the second end 150b, 152b) such that the seal members 176, 178 are biased in a closed position and such that the seal members 176, 178 are more readily openable when exposed to gas/air pressure. The half seal members 176, 178 are movable by gas/air pressure, such that when compressed gas enters the internal chamber 158, the seals 176, 178 open and allow the compressed gas and the cable 2 to travel into and through the conduit 4. In the absence of gas/air pressure within the internal chamber 158, the seals 176, 178 close such that pressurized gas/air within the conduit 4 cannot escape back into the internal chamber 158 which would have the undesired effect of pushing the cable 2 out of the conduit 4 and back into the internal chamber 158. As such, the seal members 176, 178 act as a check valve or reed seal. It is noted that although two seal structures are shown (formed by seal members 176, 178), it is possible to use only one seal structure or more than two seal structures, such as three, four, five, or six seal structures. The disclosed configuration is particularly beneficial in systems where a pulse generator 10 is utilized as periods of no gas/air pressure exist between the compressed gas pulses.

[0066] As discussed previously, the system 100 may include a first flange piece 202 and a second flange piece 204. The first flange piece is shown in greater detail at Figures 40-42 while the second flange piece is shown in greater detail at Figures 43-45. As shown, the first flange piece 202 has an aperture 214 through which the cable 2 can be fed. The second flange piece 204 is also provided with an aperture 216 through which the cable 2 can be fed. As configured, the cable 2 enters the internal chamber 158 via the aperture 214 and exits the internal chamber 158 via the aperture 216. The aperture 214 is provided with a dimension that is close to the dimension of the cable 2 while the aperture 216 is provided with a larger dimension. As such, when compressed gas enters the internal chamber 158, the compressed gas will primarily travel through the larger aperture 216 and will thus draw the cable 2 in the direction towards the second flange piece 204 and into

conduit 4. It is noted that some of the compressed gas does leak through the aperture 214, but not in sufficient quantities to impede operation. The first and second flange pieces 202, 204 may also be respectively provided with an attachment feature 218, 220 for securing the flange pieces 202, 204 to the conduits 4, 5. In the embodiment shown, the attachment features 218, 220 are tapered or conically shaped threads. However, other configurations may be utilized, such as clamps or adhesives.

[0067] Referring to Figures 46-47, a connector assembly 230 is shown in which a first connector 232 engages with the first flange piece 202 and a second connector 234 engages with the second flange piece 204. The connectors 232, 234 are each provided with complementary shaped locking lugs 236, 238 such that the connectors 232, 234 can be secured together in a twist-lock fashion. The connectors 232, 234 are also provided with longitudinal slots 240, 242 such that the connectors 232, 234 can be laterally slid over the conduits 4, 5 and then longitudinally over the flange pieces 202, 204 without requiring preassembly of the connectors 232, 234 onto the conduits 4, 5 before blowing the fiber through the assembly 100.

[0068] Referring back to Figures 1 and 2, the pulse generator 10 can be provided such that compressed gas is introduced into the internal chamber 158 in intermittent pulses instead of continuously. This intermittent action can be created manually through the operation of a hand operated valve, by an automated valve that opens and closes on predefined or selected intervals, or by a rotating plate or other member that momentarily opens and closes the pathway between the gas/air compression system 6 and the assembly 100. It is believed that a pressure wave is introduced into the assembly 100 and conduit 4 when pulsed gas/air is introduced that temporarily transports the cable 2 with greater force than can be achieved with a continuous gas/air stream at the same pressure. It has been learned that introducing pulses into the compressed gas stream at a first pressure will allow a cable to be blown into the conduit 4 while a continuous compressed gas stream at the same first pressure will be insufficient to move the cable 2. As such, a gas/air compression system 6 can be utilized that generates a pressure of only about 30-40 pounds per square inch (psi) can be successfully utilized in a pulsed blowing application. In comparison, many existing cable blowing systems, which are relatively large and costly, require compressed gas pressures exceeding 100 psi.

[0069] To aid the blowing process, the cable 2 may be provided with one or more ferrules or pistons 9 proximate the end of the cable 2, as shown in Figures 1 and 2. During a pulse blowing process, as described above, it is believed that pressure waves developed by pulsing the gas/air impact the piston 9 and create sufficient force to incrementally move the cable 2 through the conduit 4. With each pulse, the cable 2 will move through the conduit at least until the pressure equalizes on each side of the piston 9 as the pressure wave passes the piston. It has been found that cable feeding performance increases as the pulses are sharper and discrete. For example, an effective approach that has been found is to provide compressed gas pulses that are separated by short periods of no compressed gas being delivered to the internal chamber 158 and conduit 4. This approach has been found to be more effective than alternating gas/air pressure between a relatively high pressure and a relatively low pressure.

[0070] It has been found that a piston 9 having a diameter that is very close to the internal dimension of the conduit 4 (e.g. a 2.75 mm piston in a 3 mm internal conduit bore) will allow a constant gas or air pressure to move the cable 2 through the conduit. However, the low clearance required for such an implementation can lead to the piston 9 becoming jammed or stuck within the conduit 4 where sharp bends or kinks might be present. Where greater clearance is provided (e.g. a 2 mm piston in a 3 mm internal conduit bore), the jamming issue can be solved, but it has been found that the same constant gas/air pressure that can be used with the larger piston will not be sufficient to move the cable 2 through the conduit 4. However, it has been found that providing compressed gas in the form of compressed air in pulses at this same pressure (e.g. 30-40 psi) will result in the cable 2 being blown into the conduit 4. Although a single piston 9 is shown, multiple pistons 9 may also be used, such as two, three, or four pistons.

[0071] Various modifications and alterations of this disclosure will become apparent to those skilled in the art without departing from the scope and spirit of this disclosure, and it should be understood that the scope of this disclosure is not to be unduly limited to the illustrative embodiments set forth herein.

What is claimed is:

1. A cable blowing assembly for blowing a cable through a conduit, the cable blowing assembly comprising:
 - a. a first housing part and a second housing part being mateable with the first housing part, the first housing part having a compressed gas inlet;
 - b. a first internal chamber part being at least partially received within the first housing part, the first internal chamber part defining a first cavity and an opening between the first cavity and the compressed gas inlet;
 - c. a second internal chamber part being at least partially received within in the second housing part, wherein the first and second cavities form an internal chamber when the first and second internal chamber parts are mated together;
 - d. a first flange piece having a first aperture through which the cable can be fed into the internal chamber, the first flange piece being mountable between the first and second internal chamber parts; and
 - e. a second flange piece having second aperture through which the cable can be fed out of the internal chamber, the second flange piece being mountable between the first and second internal chamber parts, wherein the second aperture has a dimension that is larger than a corresponding dimension of the first aperture.
2. The cable blowing assembly of claim 1, wherein a seal structure is provided within the internal chamber.
3. The cable blowing assembly of claim 2, wherein two seal structures are provided within the internal chamber.
4. The cable blowing assembly of claim 1, further comprising:
 - a. a clamp structure configured to hold the first and second housing parts together once mated.

5. The cable blowing assembly of claim 1, wherein the first and second internal chamber parts are formed from a material that is more flexible and is less hard than a material from which the first and second housing parts are formed.
6. The cable blowing assembly of claim 1, wherein the first and second internal chamber parts are each provided with sealing structures that engage to form an internal chamber seal when the first and second internal chamber parts are mated together.
7. The cable blowing assembly of claim 1, wherein each of the first and second flange pieces is provided with threads for engaging and securing to a conduit.
8. A cable blowing system for blowing a cable through a conduit, the cable blowing system comprising:
 - a. a compressed gas source;
 - b. a cable blowing assembly including an internal chamber and a compressed gas inlet that places the internal chamber in fluid communication with the compressed gas source, the cable blowing assembly including at least one sealing structure disposed within the internal chamber and located between the compressed gas inlet and the conduit, the at least one sealing structure being in an open position when the internal chamber is in fluid communication with the compressed gas source, the at least one sealing structure being in a closed position when the internal chamber is isolated from the compressed gas source;
 - c. a pulse generator disposed between the compressed gas source and the cable blowing assembly, the pulse generator being configured to alternately place the internal chamber in fluid communication with the compressed gas source and to isolate the internal chamber from the compressed gas source.
9. The cable blowing system of claim 8, wherein two seal structures are provided within the internal chamber.

10. The cable blowing system of claim 8, further comprising:
 - a. a first housing part and a second housing part being mateable with the first housing part, the first housing part having a compressed gas inlet, wherein the internal volume is formed between the first and second housing parts.
11. The cable blowing system of claim 10, further comprising:
 - a. a first internal chamber part being at least partially received within the first housing part, the first internal chamber part defining a first cavity and an opening between the first cavity and the compressed gas inlet;
 - b. a second internal chamber part being at least partially received within in the second housing part, wherein the first and second cavities form the internal chamber when the first and second internal chamber parts are mated together.
12. The cable blowing system of claim 11, further comprising:
 - a. a first flange piece having a first aperture through which the cable can be fed into the internal chamber, the first flange piece being mountable between the first and second internal chamber parts; and
 - b. a second flange piece having a second aperture through which the cable can be fed out of the internal chamber, the second flange piece being mountable between the first and second internal chamber parts, wherein the second aperture has a dimension that is larger than a corresponding dimension of the first aperture.
13. The cable blowing system of claim 10, further comprising:
 - a. a clamp structure configured to hold the first and second housing parts together once mated.
14. The cable blowing system of claim 11, wherein the first and second internal chamber parts are formed from a material that is more flexible and is less hard than a material from which the first and second housing parts are formed.

15. A method of installing a cable in a conduit, the method comprising:
 - a. inserting a cable through a first aperture of a first flange piece;
 - b. inserting the cable through a second aperture of the second flange piece, wherein the second aperture has a dimension that is larger than a corresponding dimension of the first aperture;
 - c. connecting the second flange piece to the conduit;
 - d. inserting the first and second flange pieces into a first internal chamber part;
 - e. mating a second internal chamber part to the first internal chamber part to form an internal chamber between the first and second internal chamber parts such that the cable enters the internal chamber through the first flange piece and exits the internal chamber through the second flange piece and such that a seal structure is formed about the cable; and
 - f. providing compressed gas to the internal chamber in pulsed cycles to cause the seal structure to open and the cable to feed through the internal chamber and into the conduit.
16. The method of installing a cable of claim 15, further comprising the step of connecting the first flange piece to a second conduit.
17. The method of installing a cable of claim 15, further comprising feeding the cable to the first flange piece from a cable is fed from a packaged coreless wound cable.
18. The method of installing a cable of claim 15, wherein the pulsed cycles are provided at a predetermined frequency.
19. The method of installing a cable of claim 18, wherein the pulsed cycles are provided by an automated mechanical pulse generator that disrupts compressed gas flow from a compressed gas source.
20. The method of installing a cable of claim 15, further including attaching one or more pistons to the cable after the step of inserting a cable through a first aperture of a first flange piece.

FIG. 1

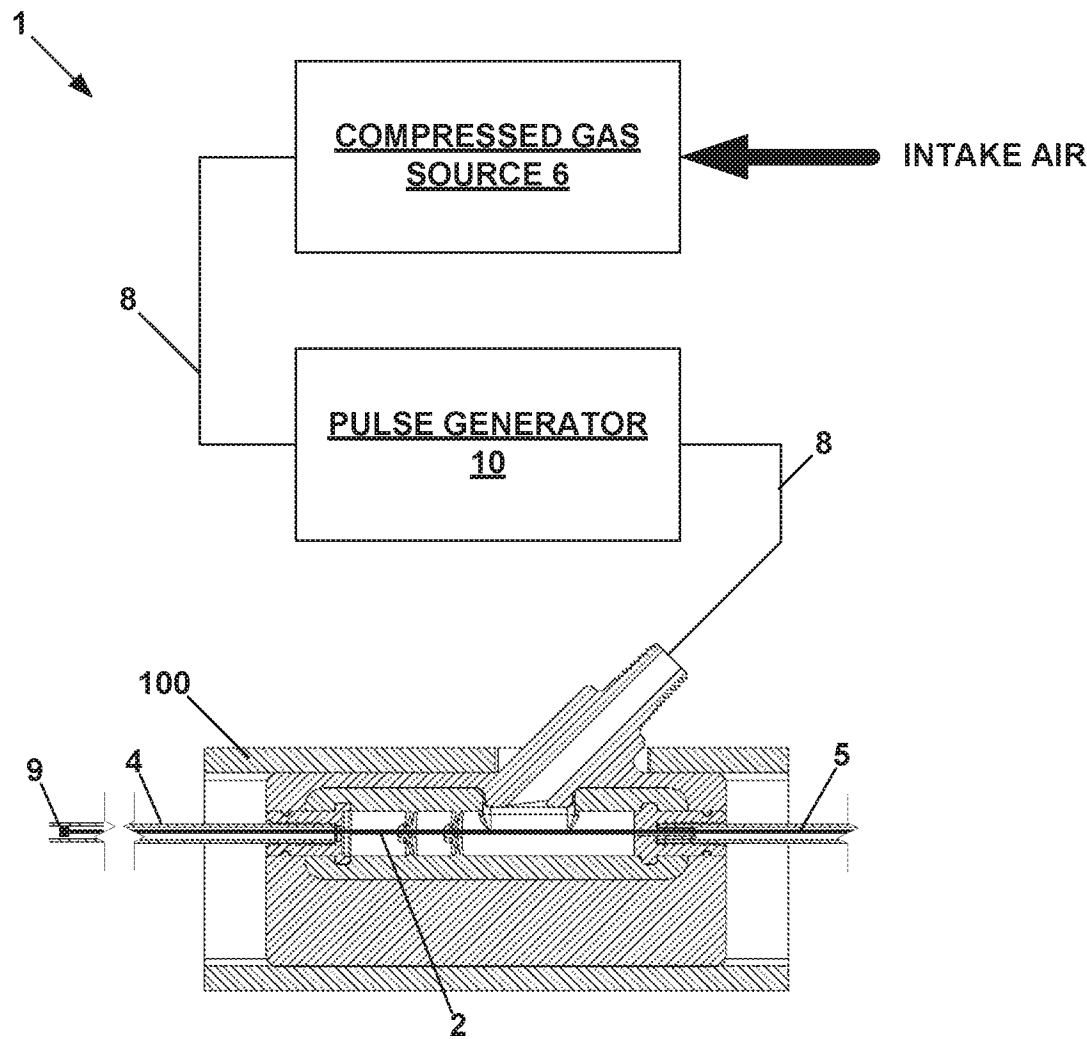


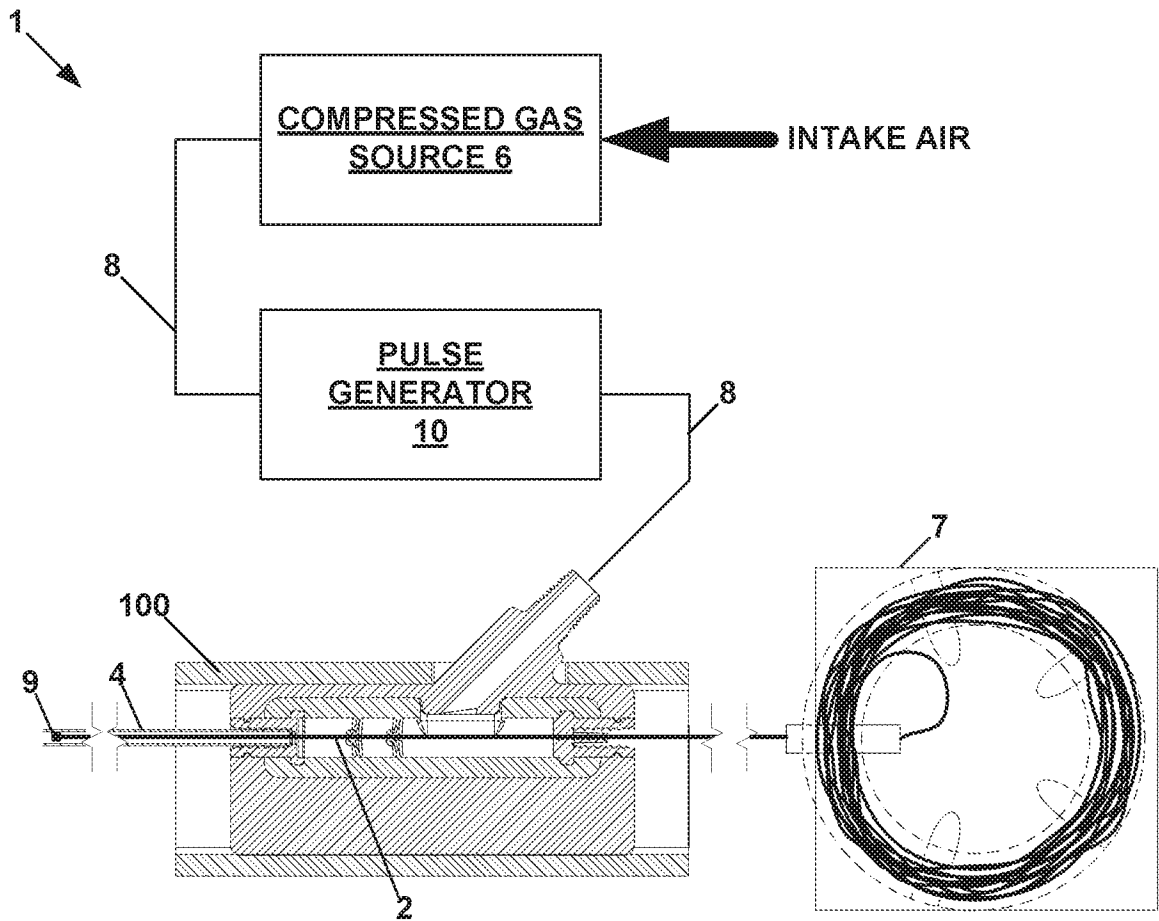
FIG. 2

FIG. 3

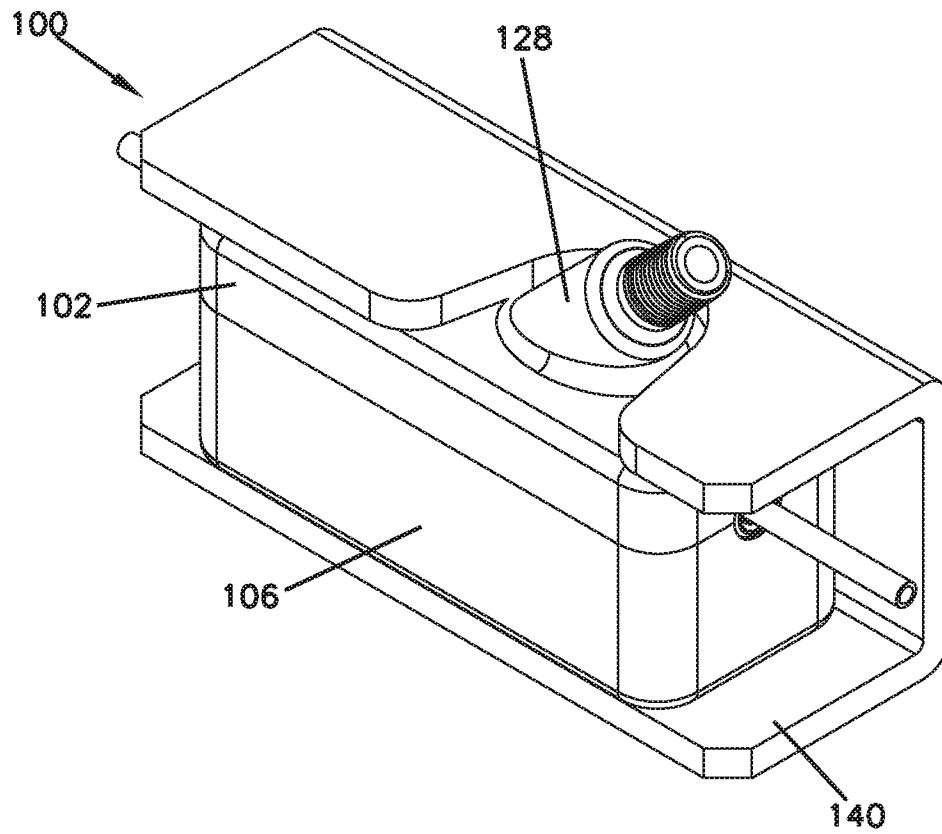


FIG. 4

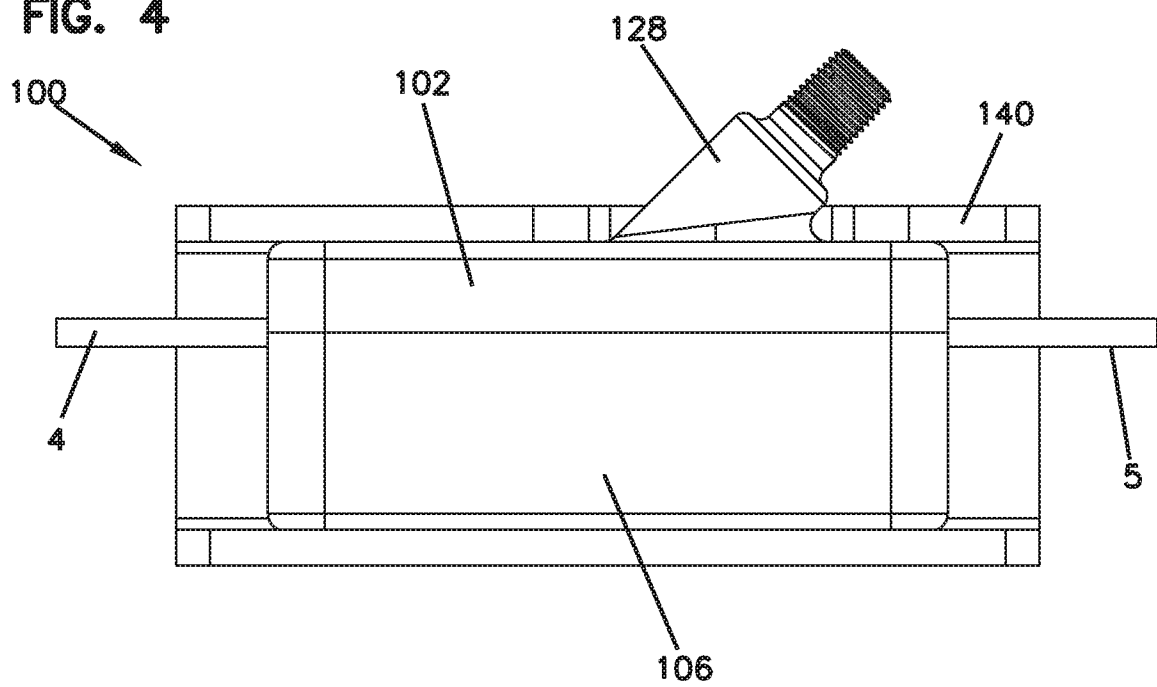


FIG. 5

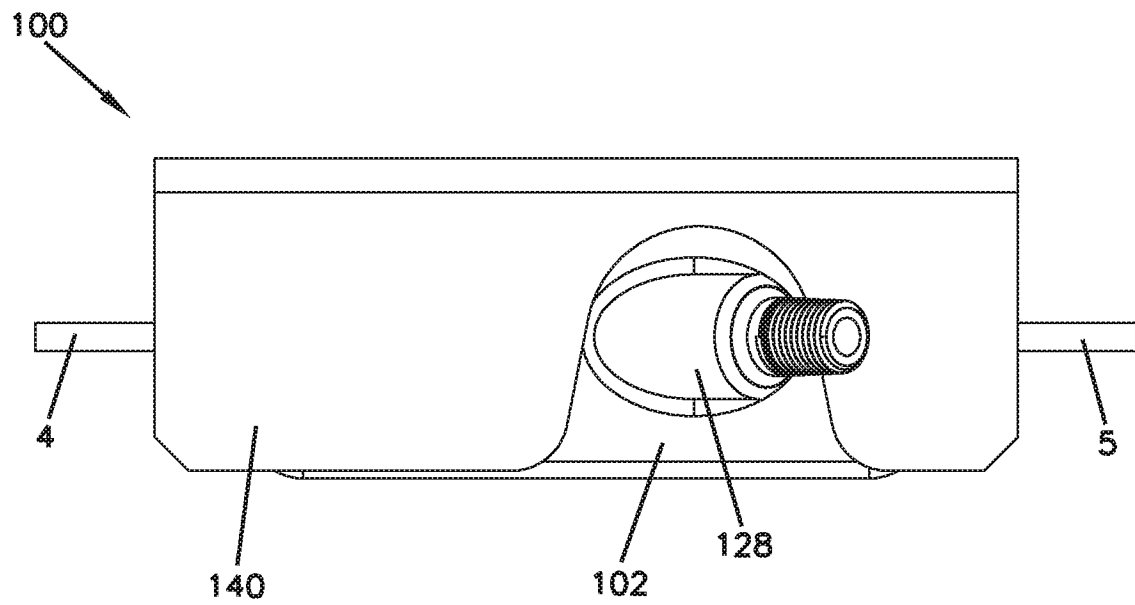


FIG. 6

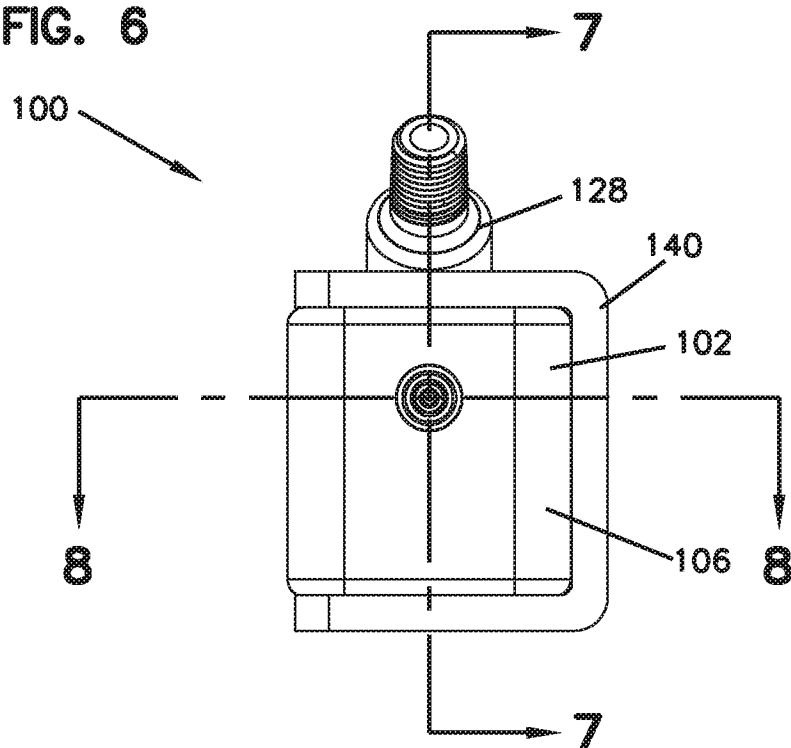


FIG. 7

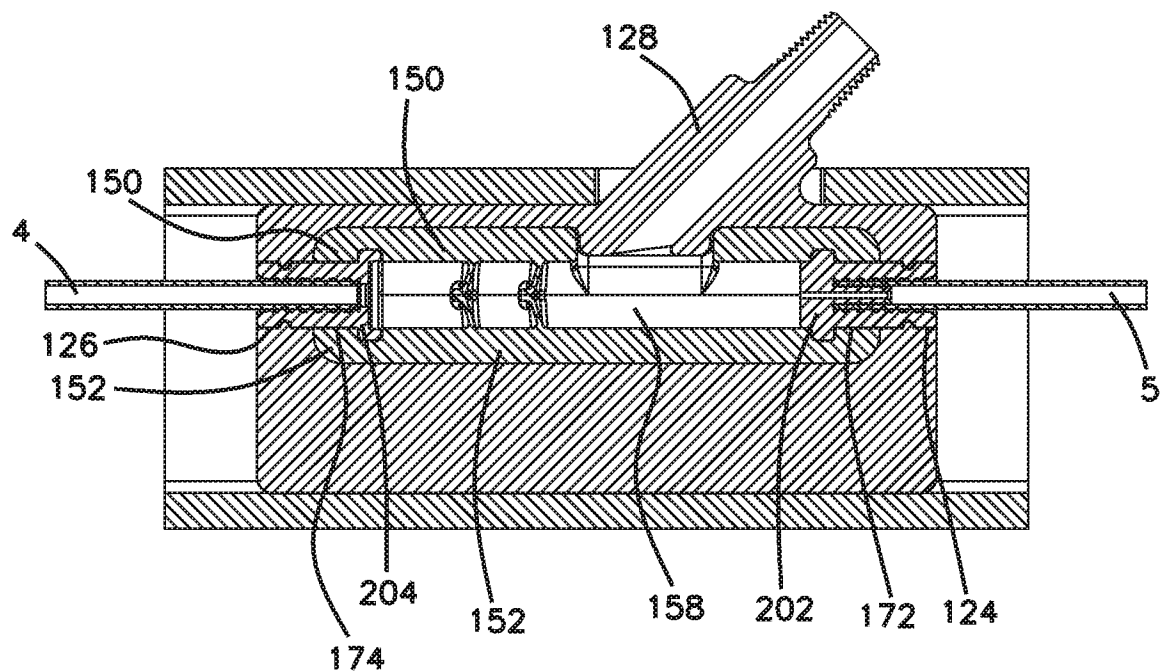


FIG. 8

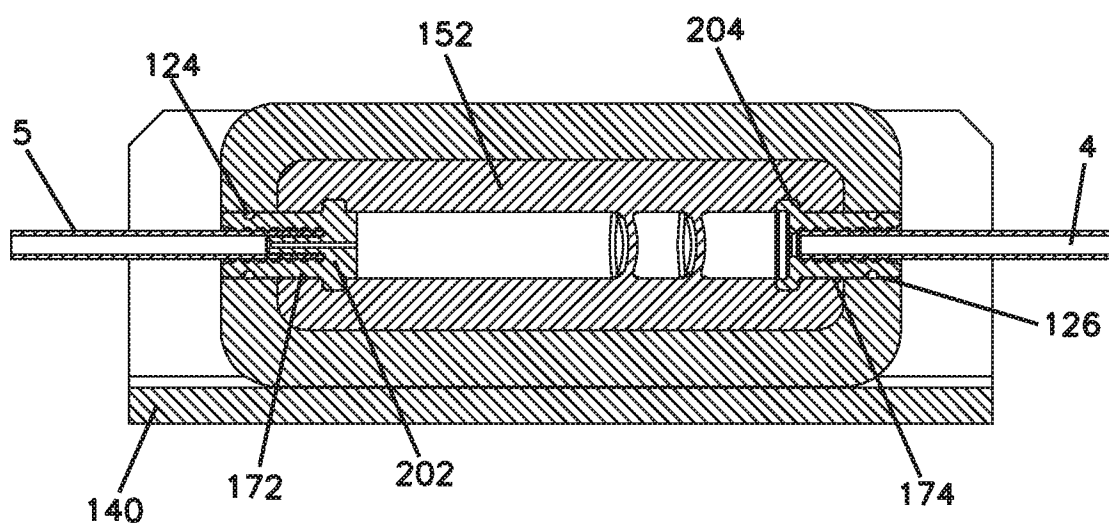


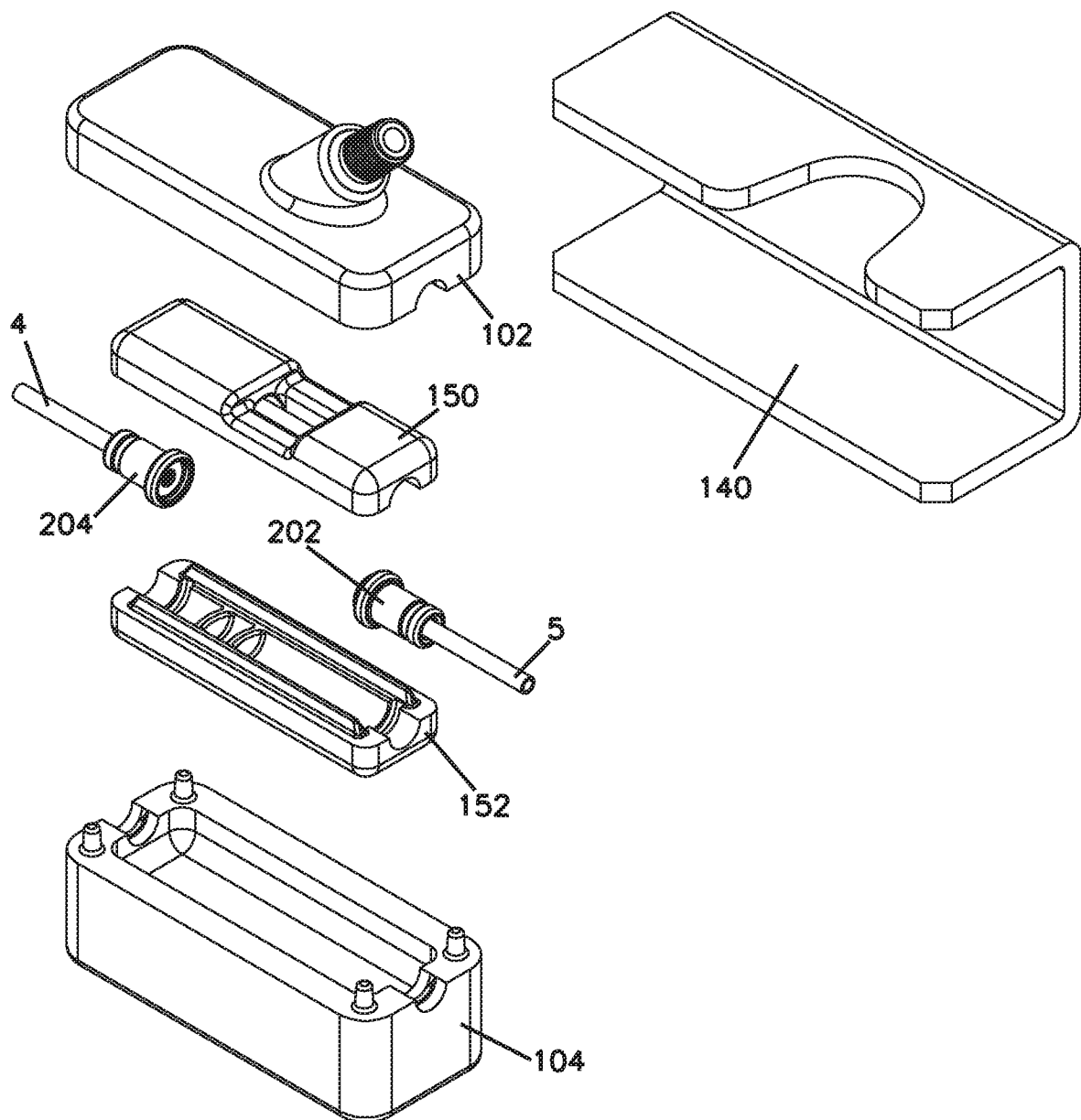
FIG. 9

FIG. 10

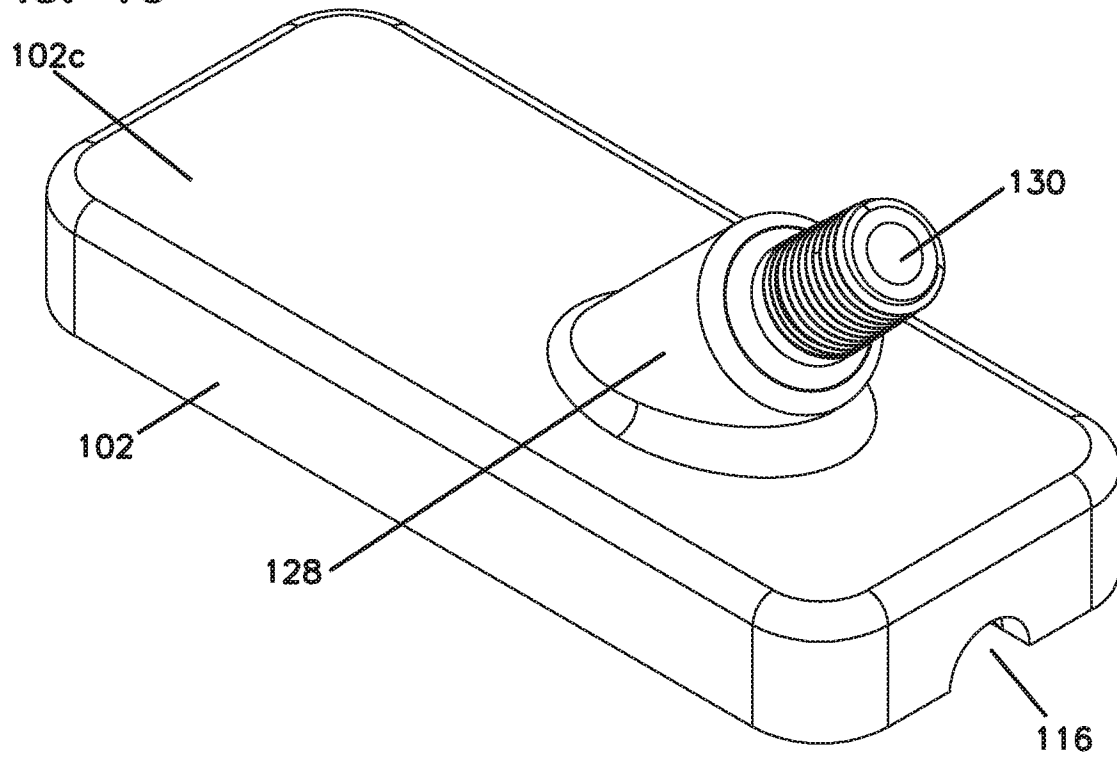


FIG. 11

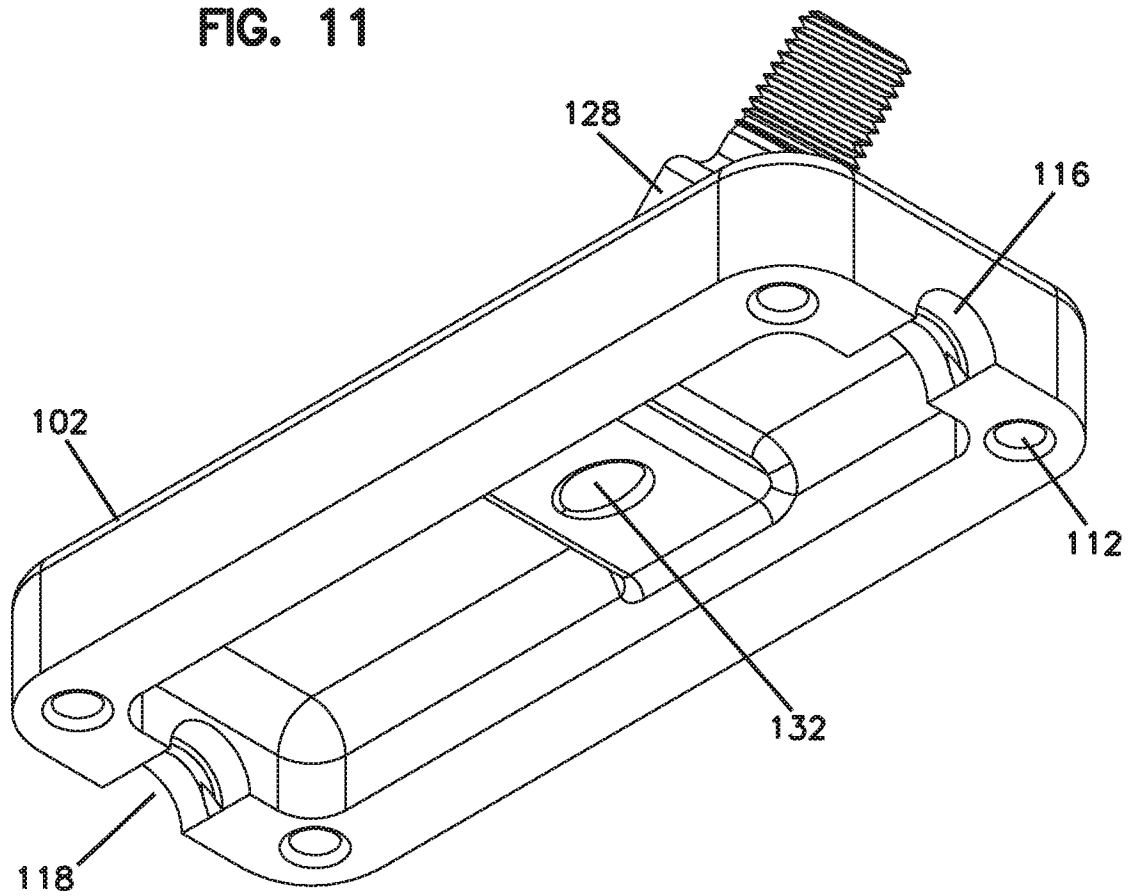


FIG. 12

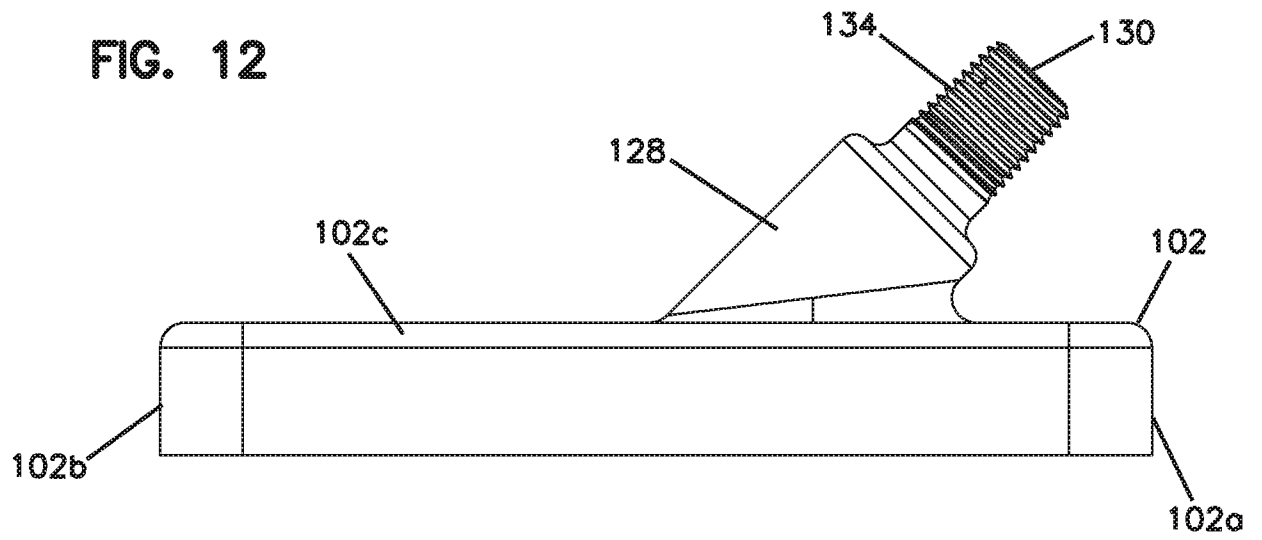


FIG. 13

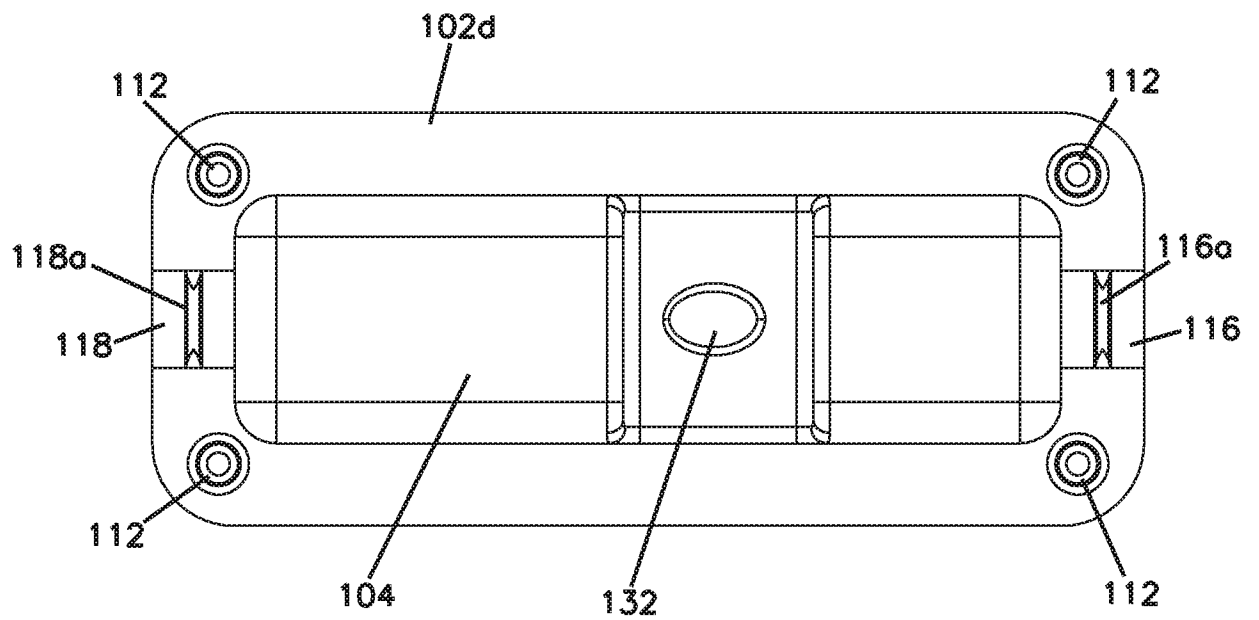


FIG. 14

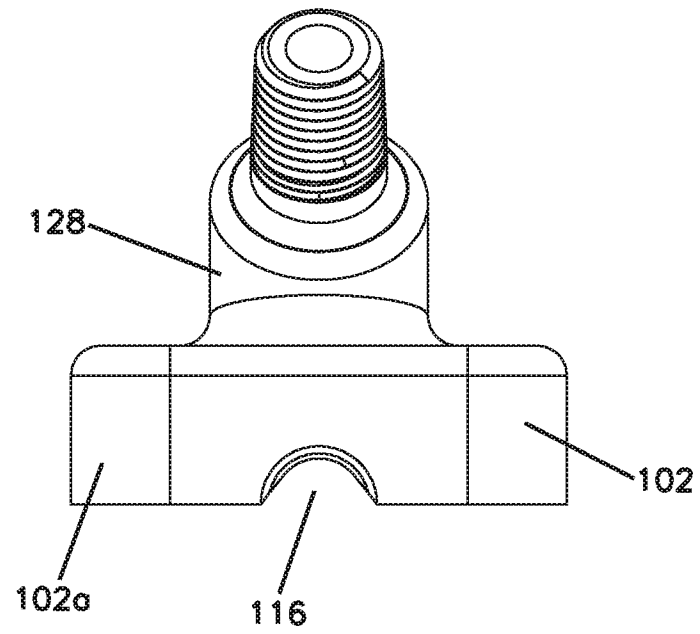


FIG. 15

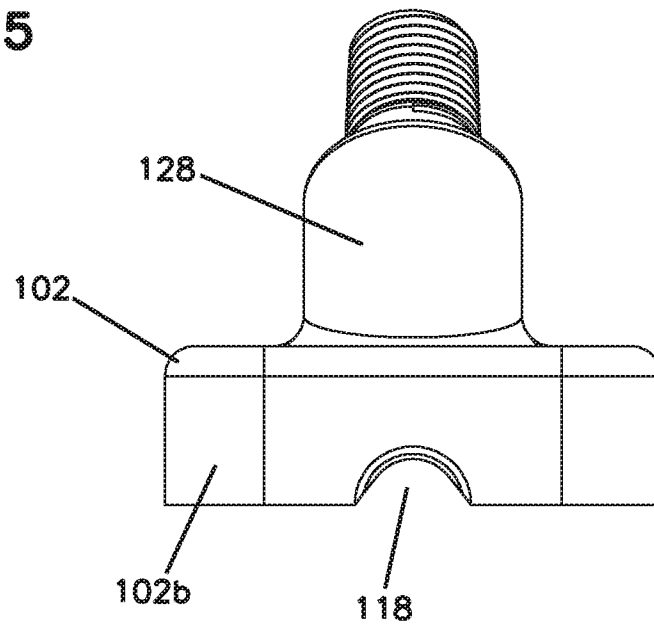


FIG. 16

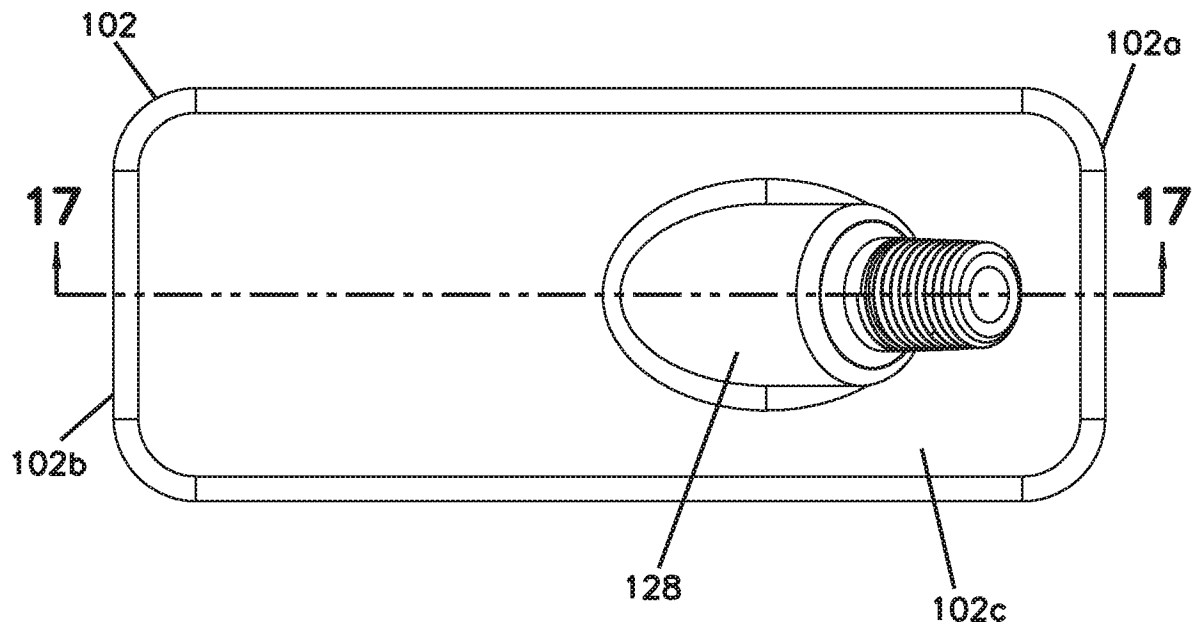


FIG. 17

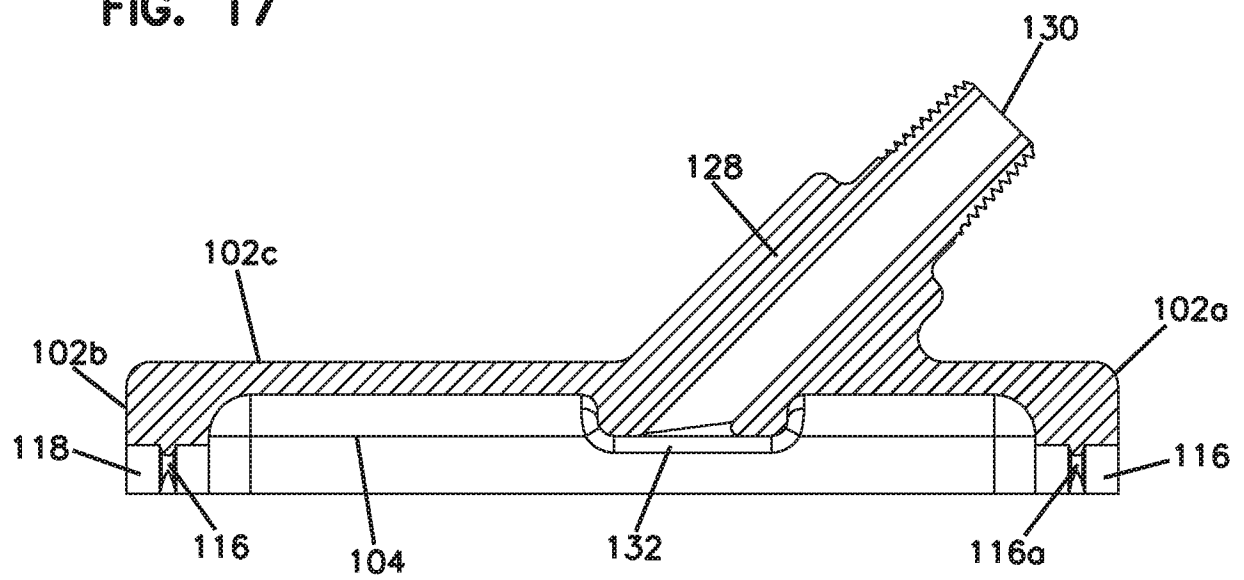


FIG. 18

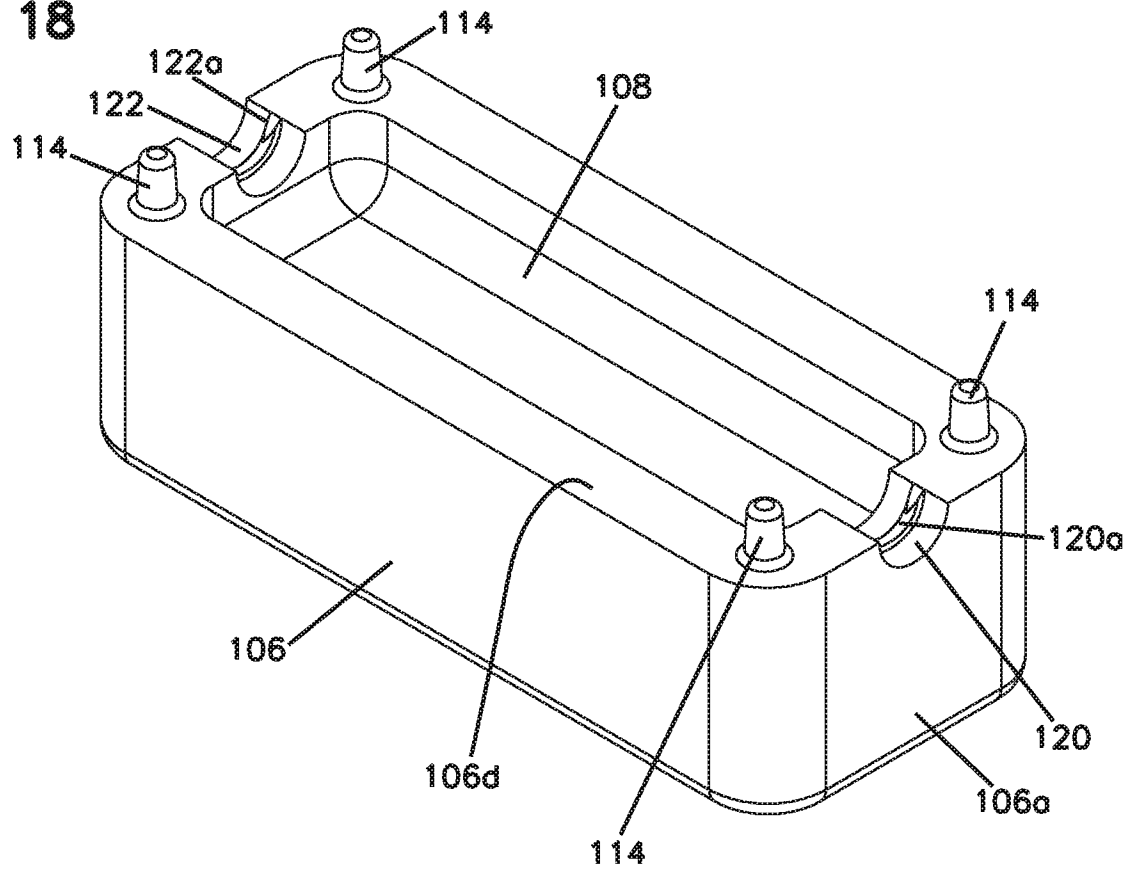


FIG. 19

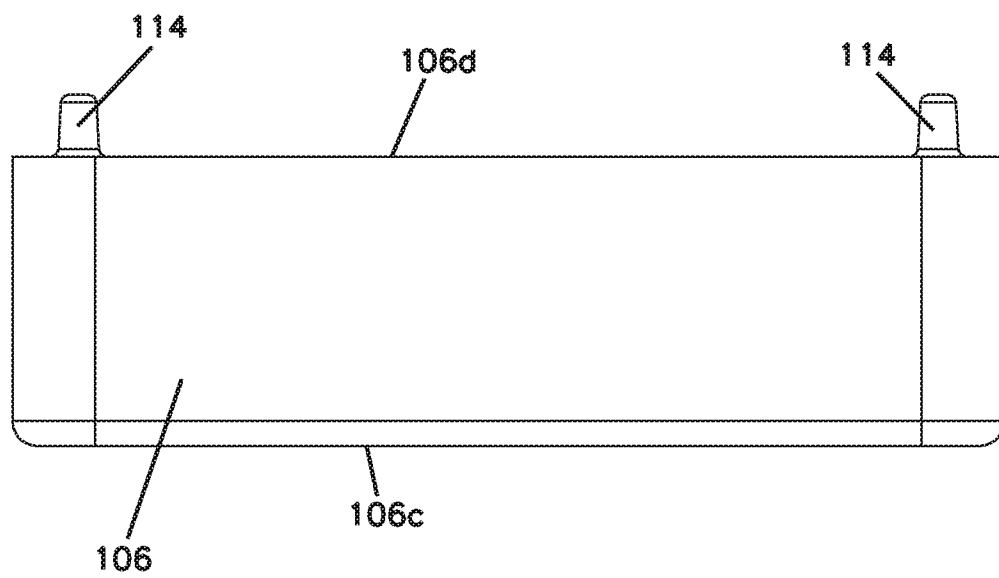


FIG. 20

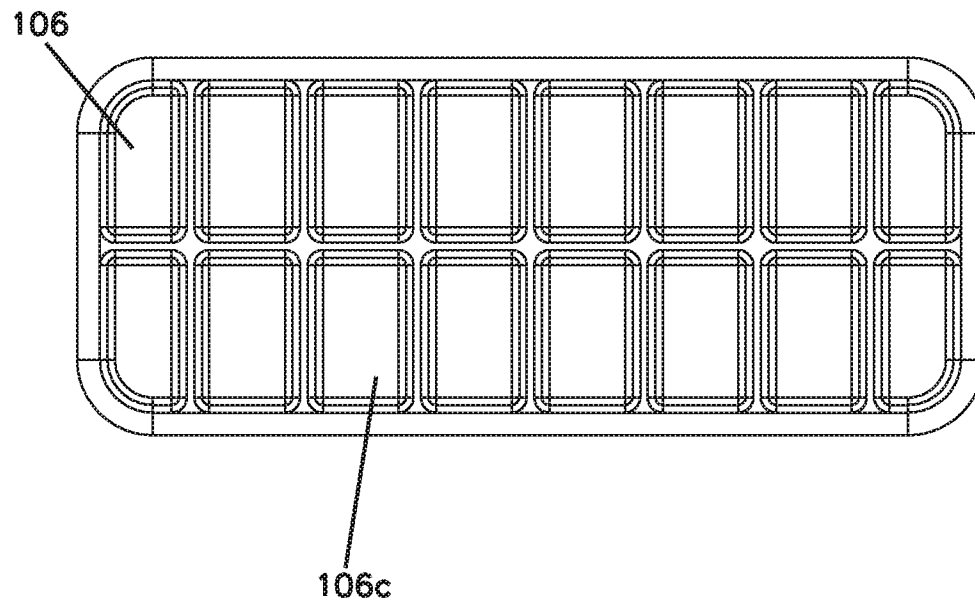


FIG. 21

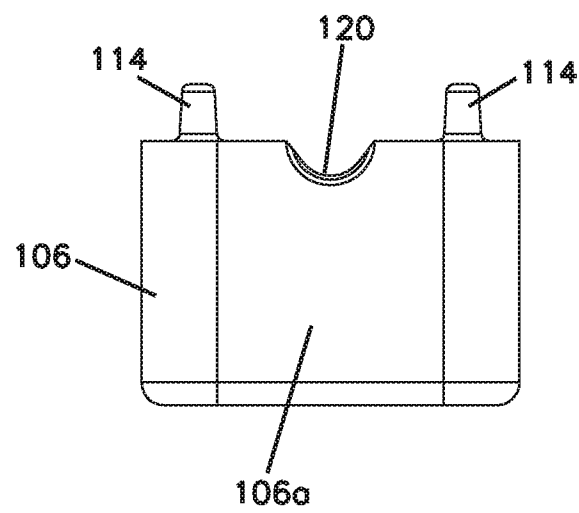


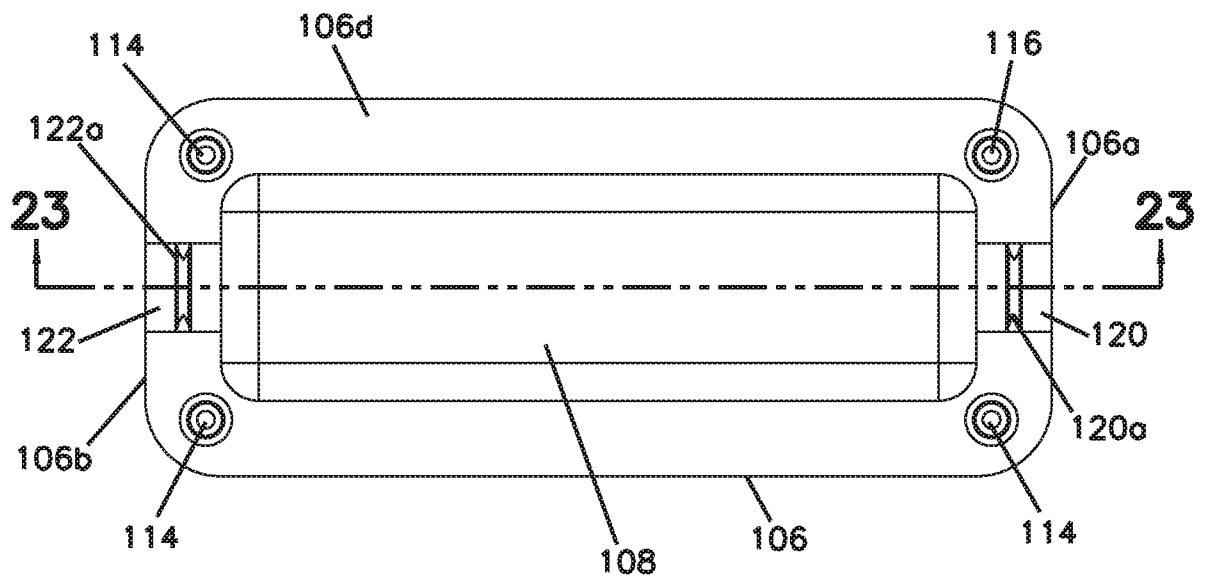
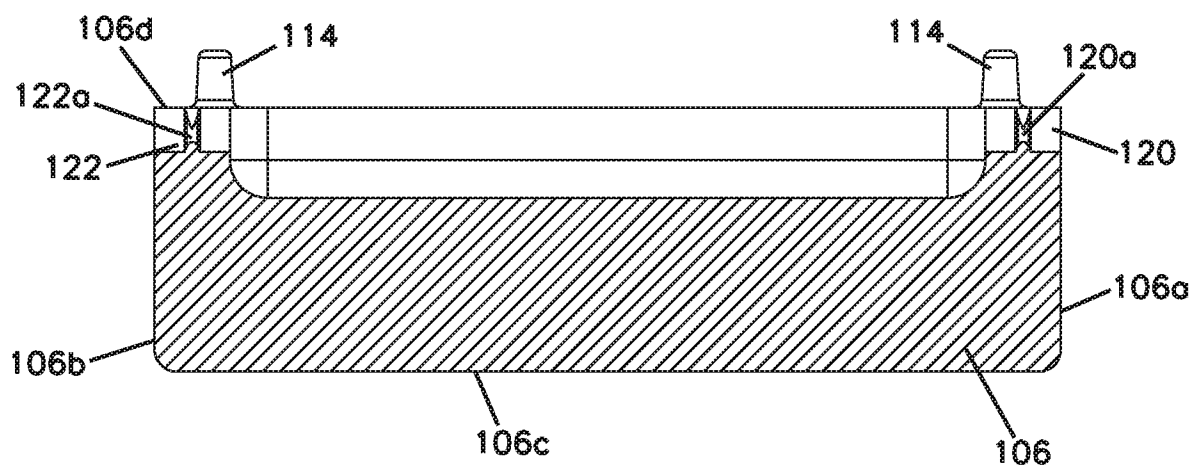
FIG. 22**FIG. 23**

FIG. 24

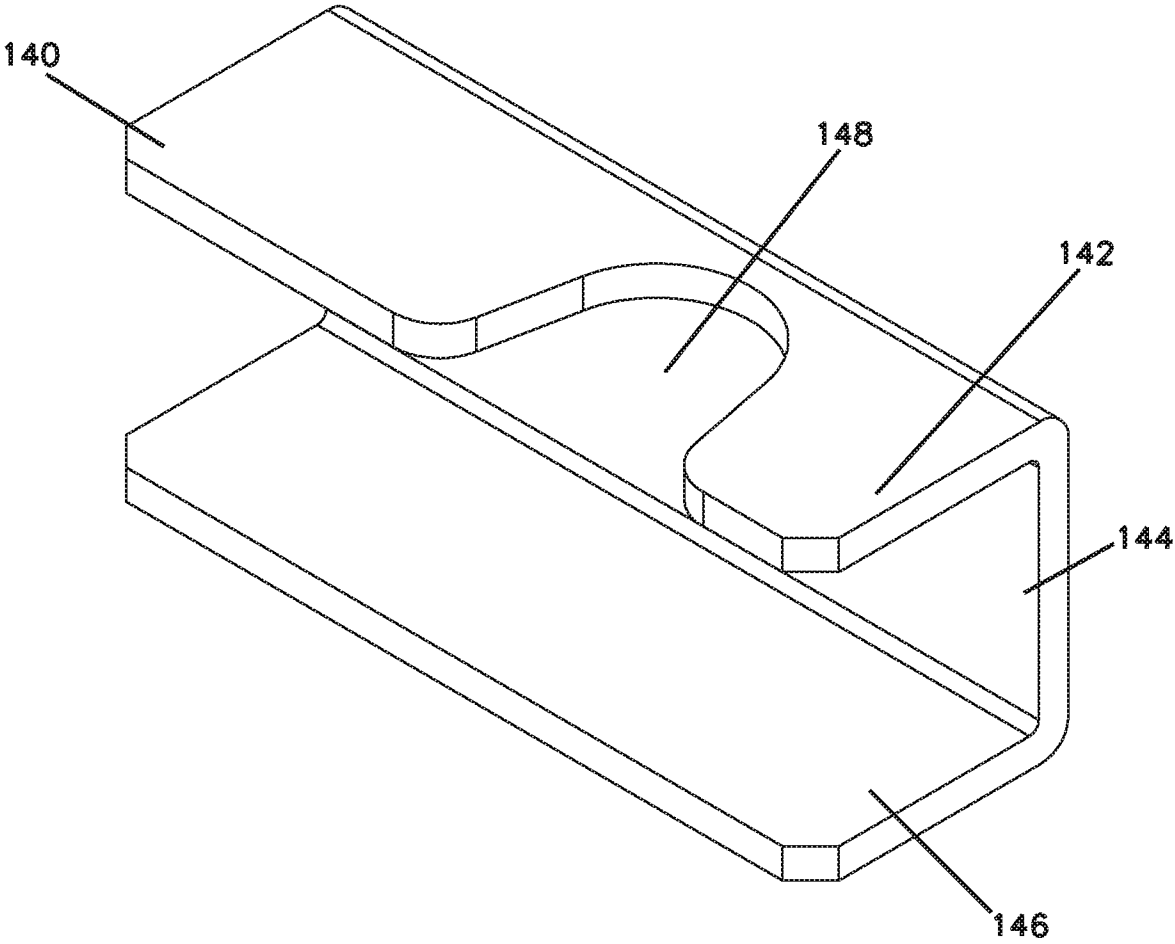


FIG. 25

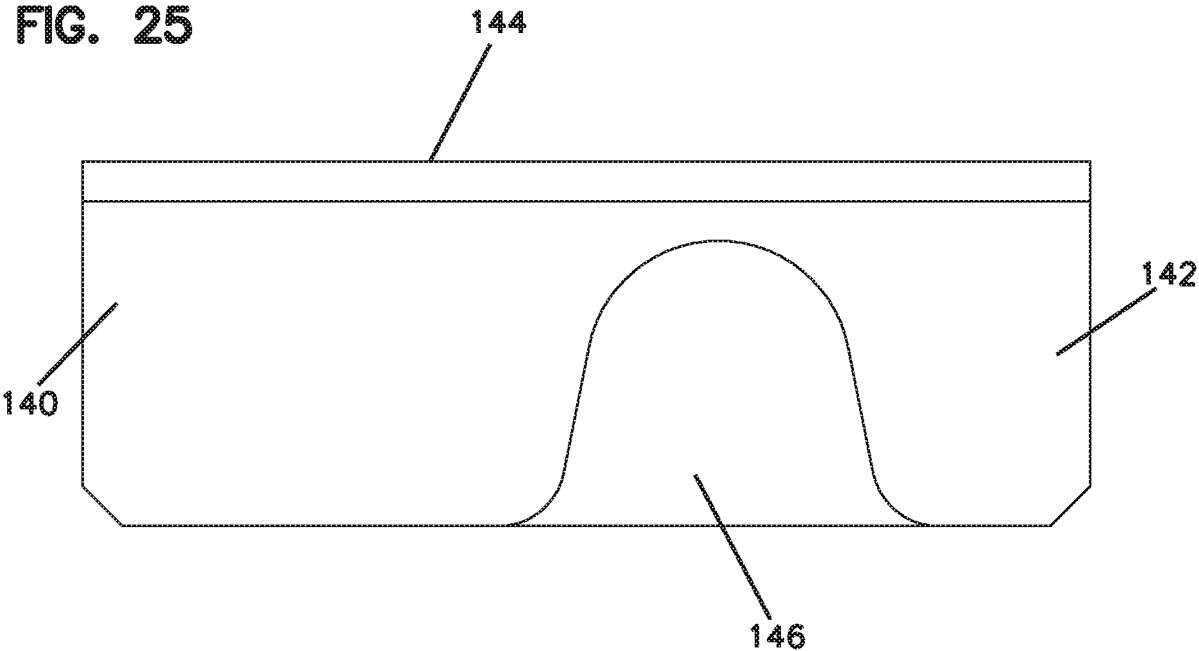


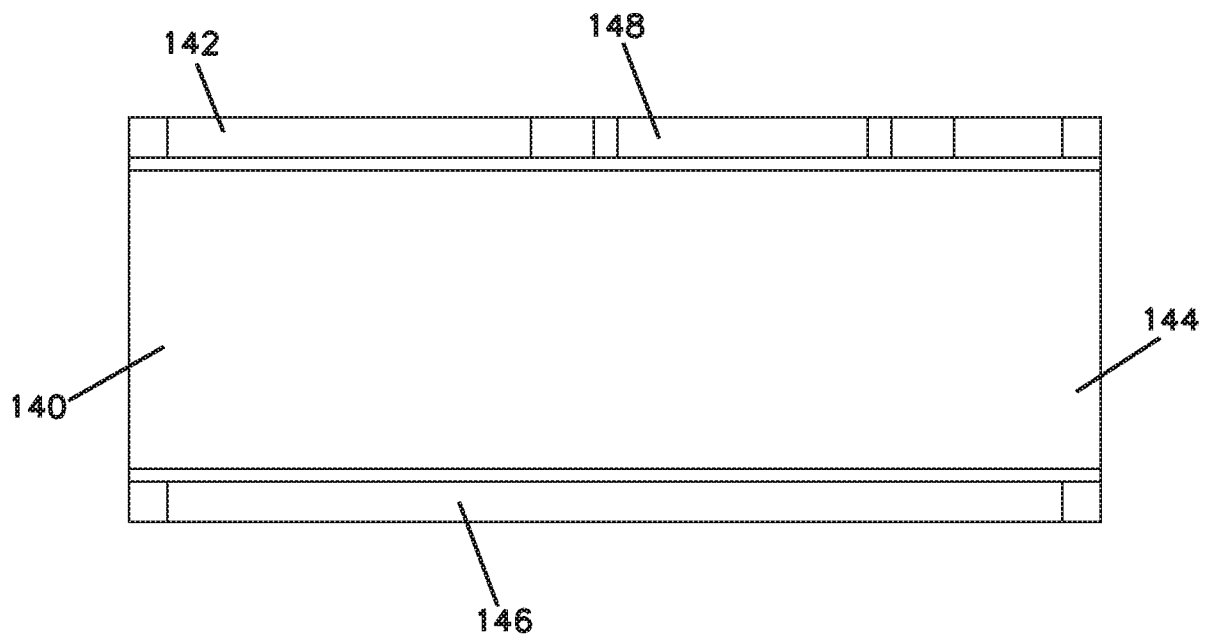
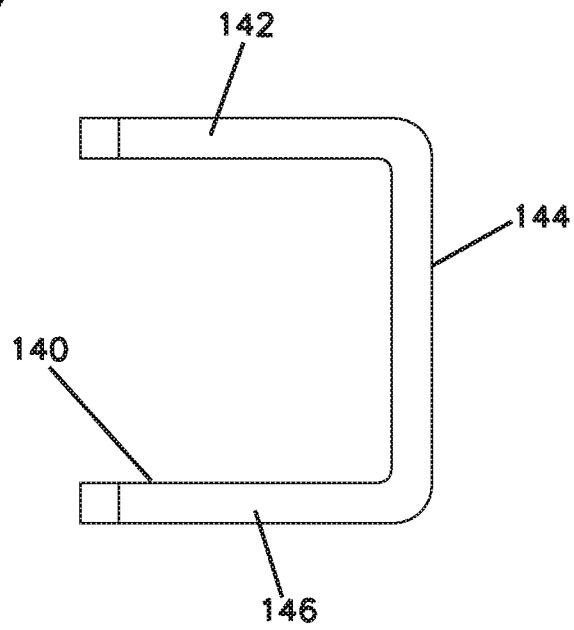
FIG. 26**FIG. 27**

FIG. 28

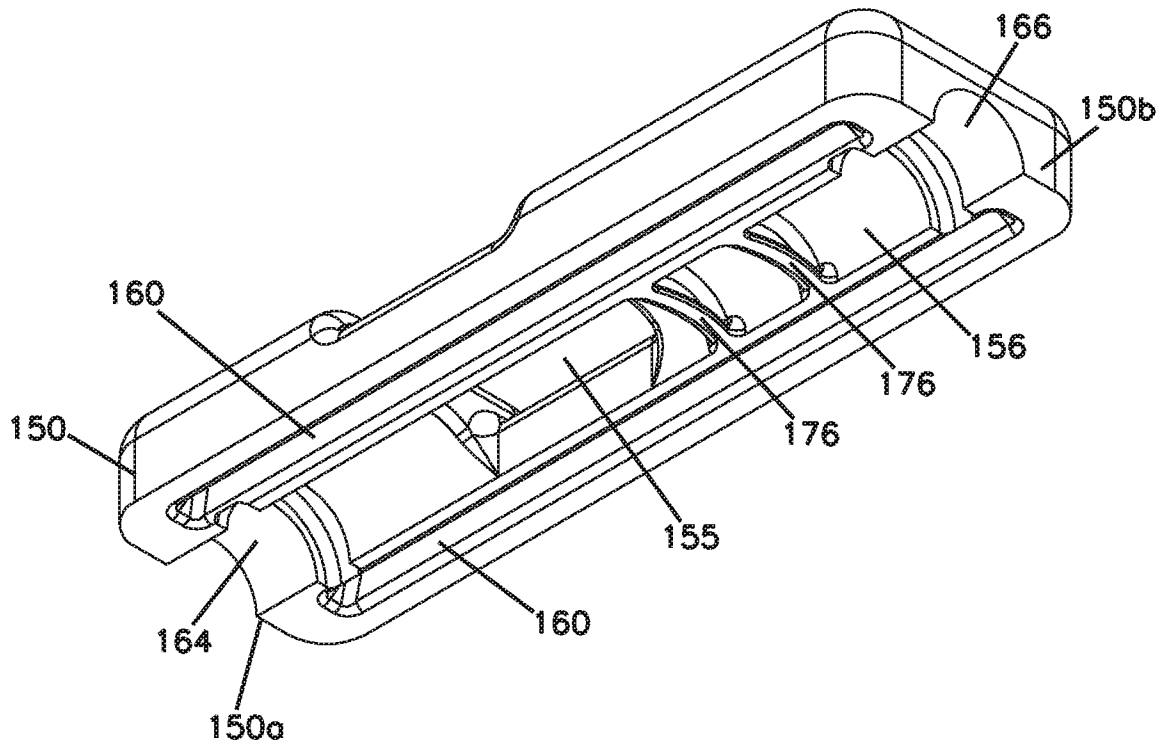


FIG. 29

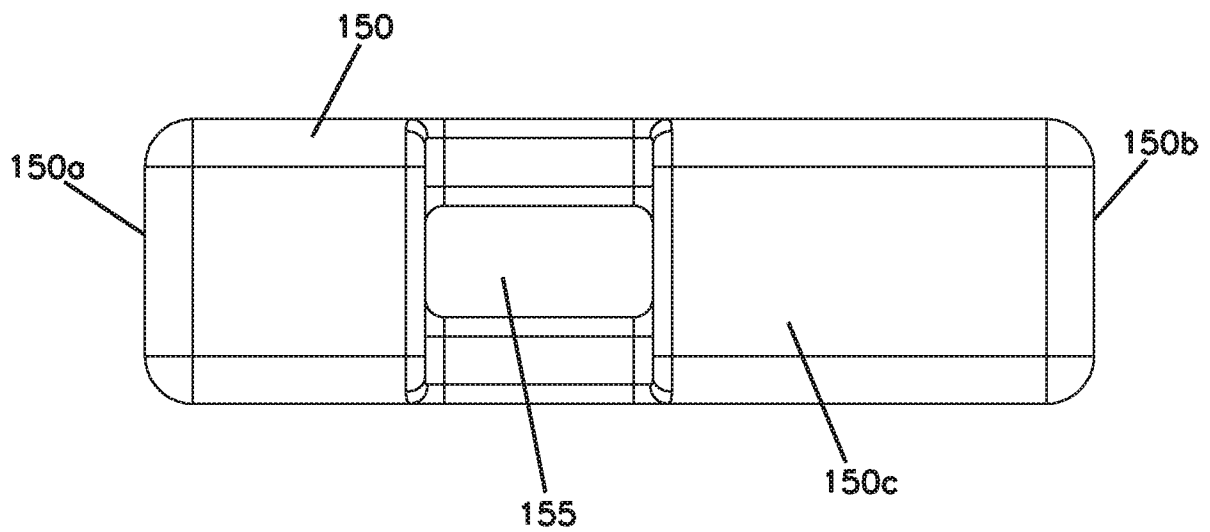


FIG. 30

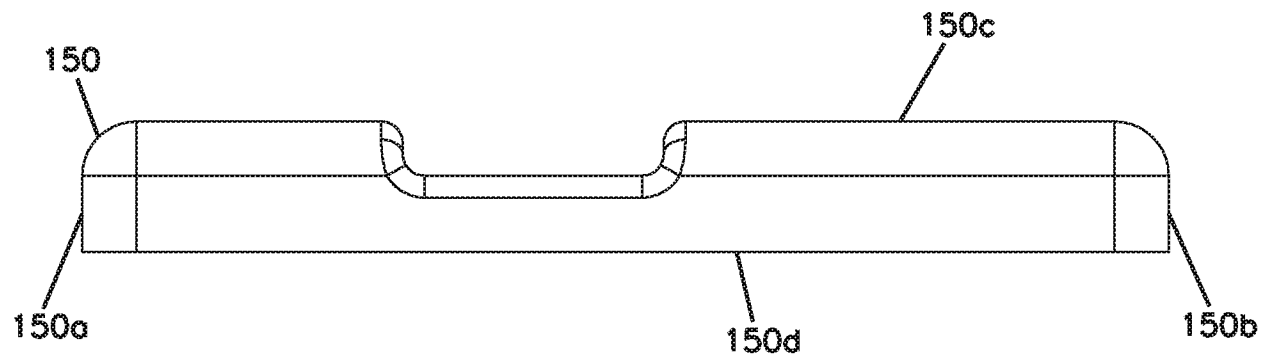


FIG. 31

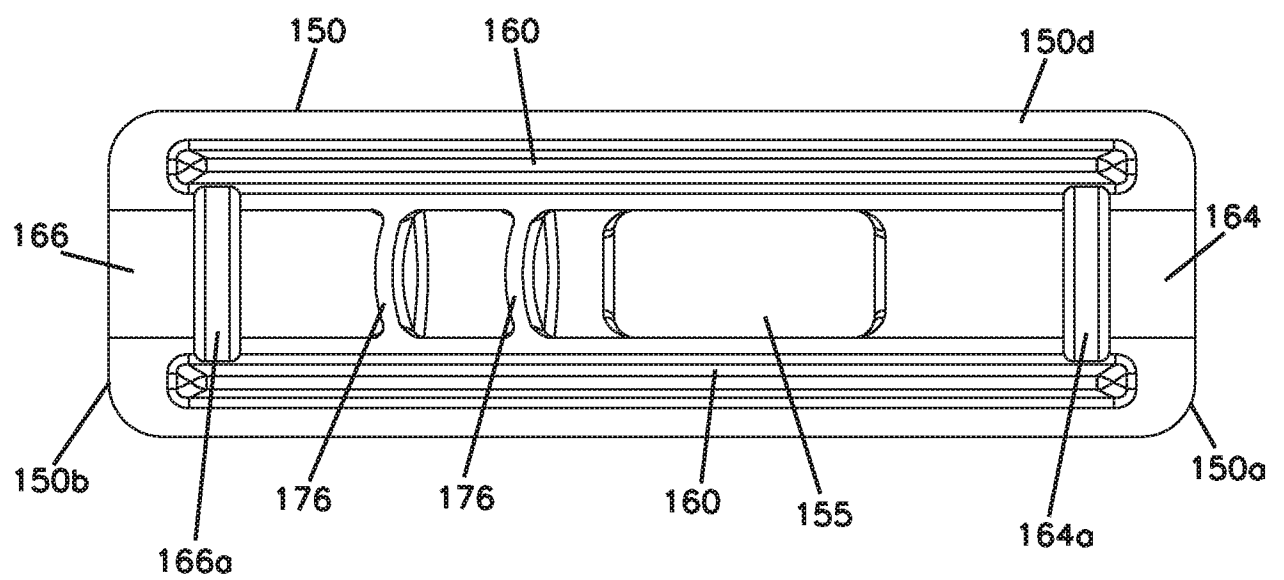


FIG. 32

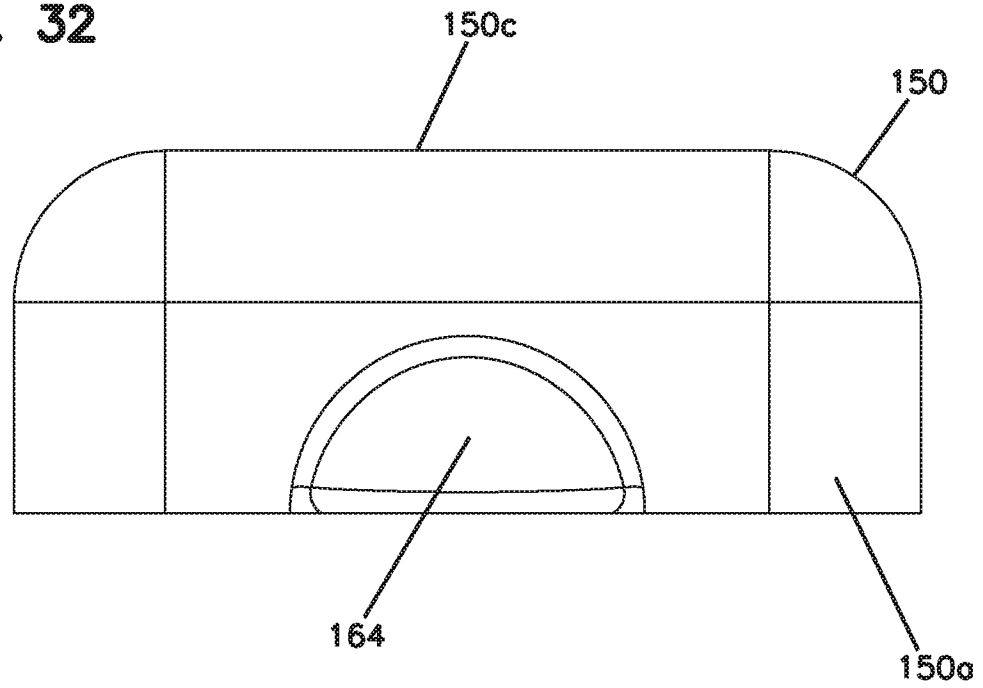


FIG. 33

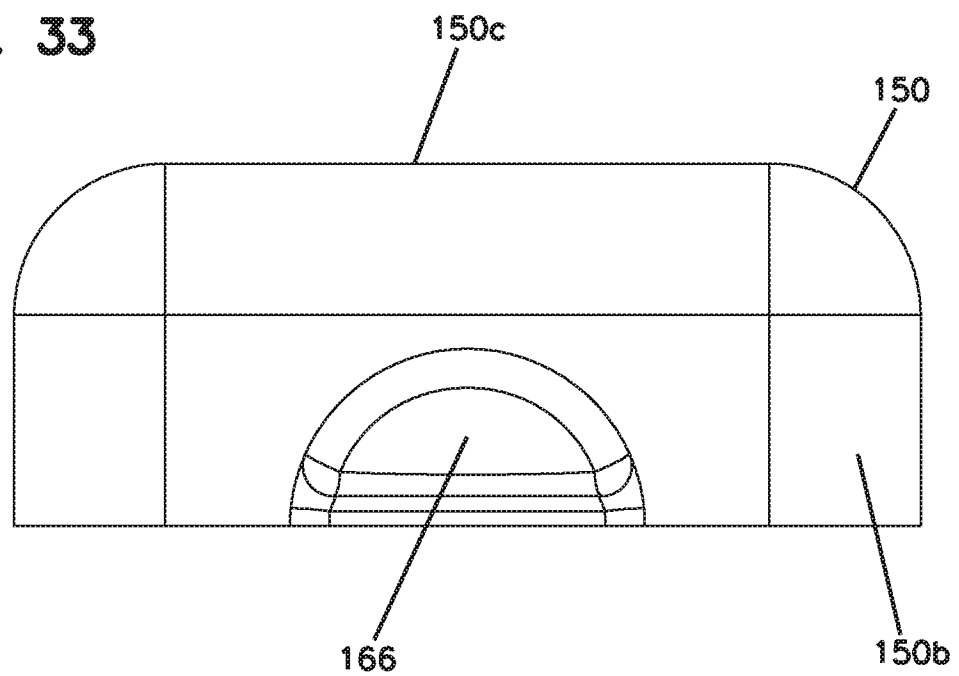


FIG. 34

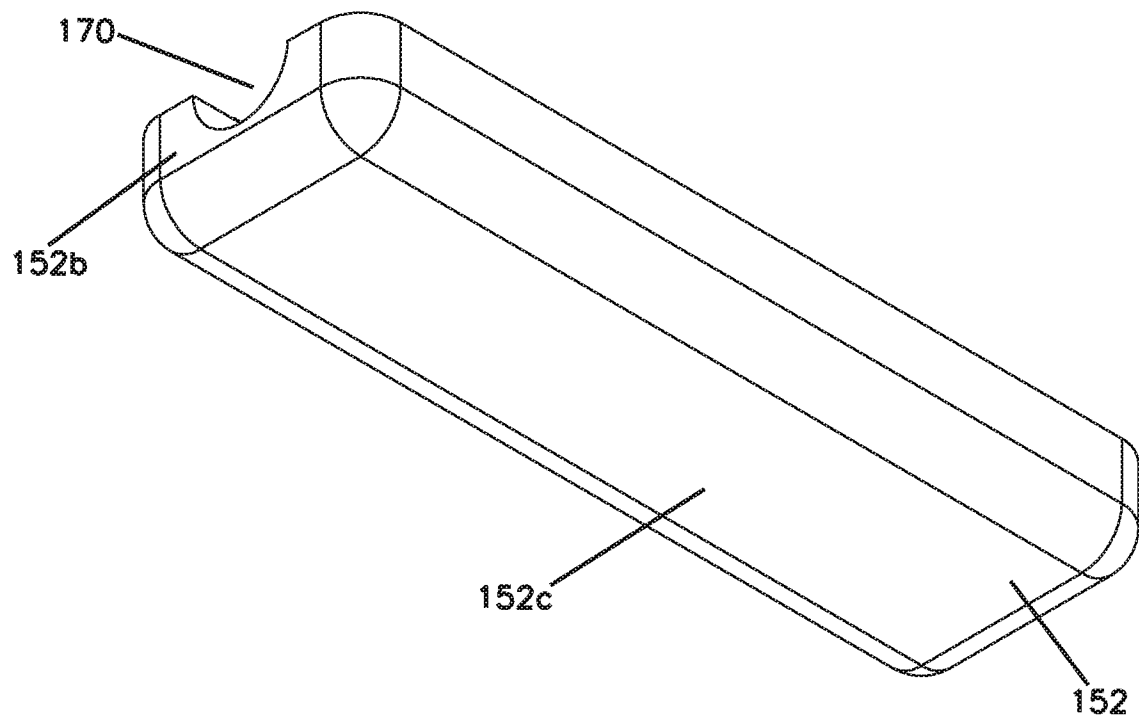


FIG. 35

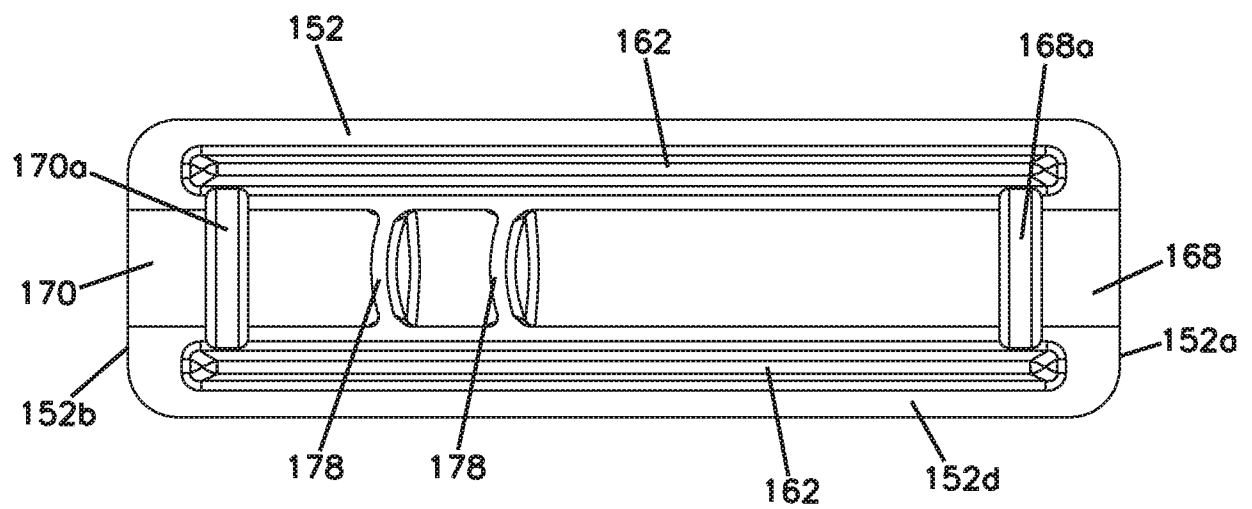


FIG. 36

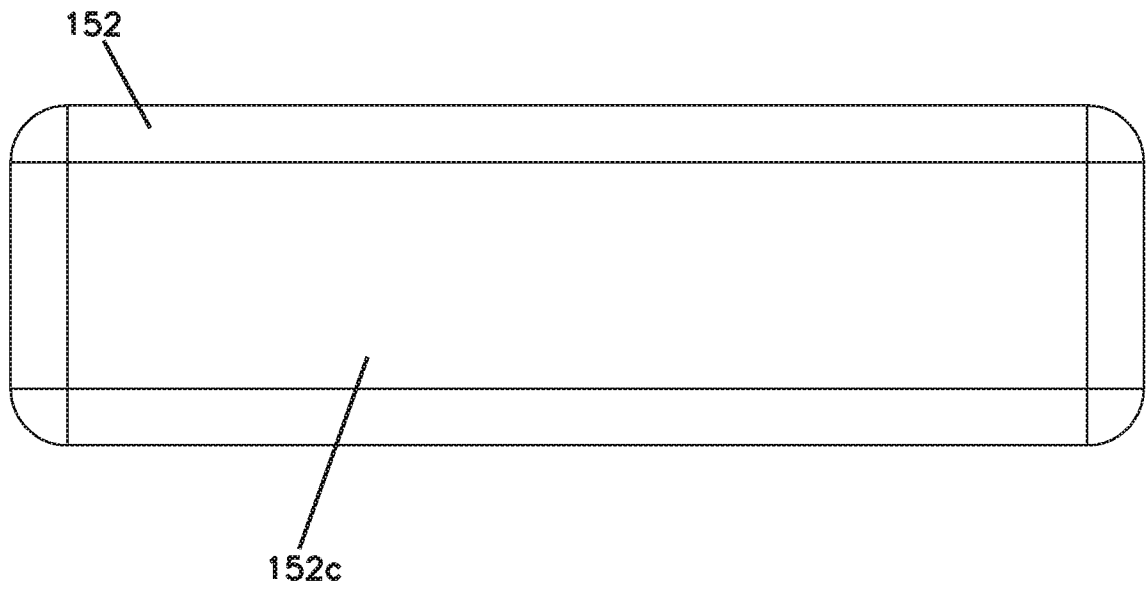


FIG. 37

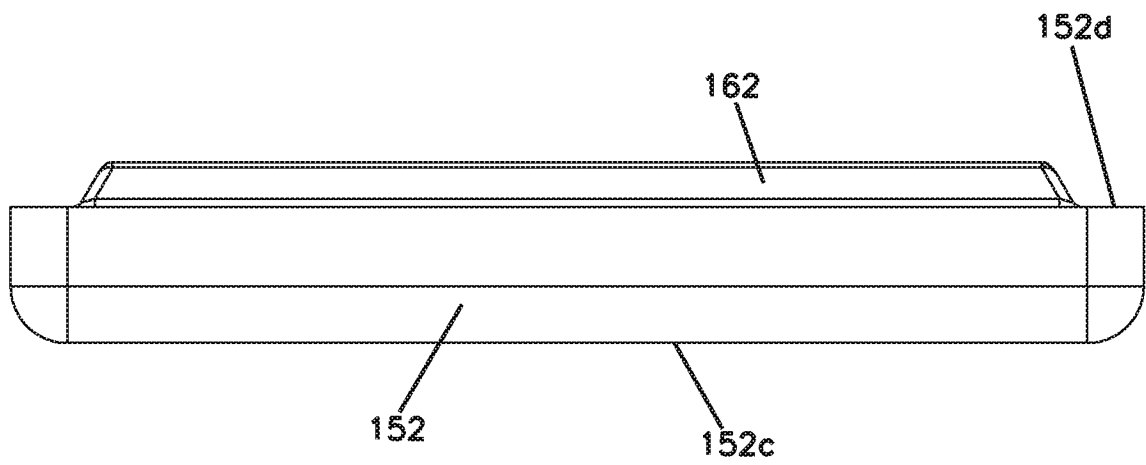


FIG. 38

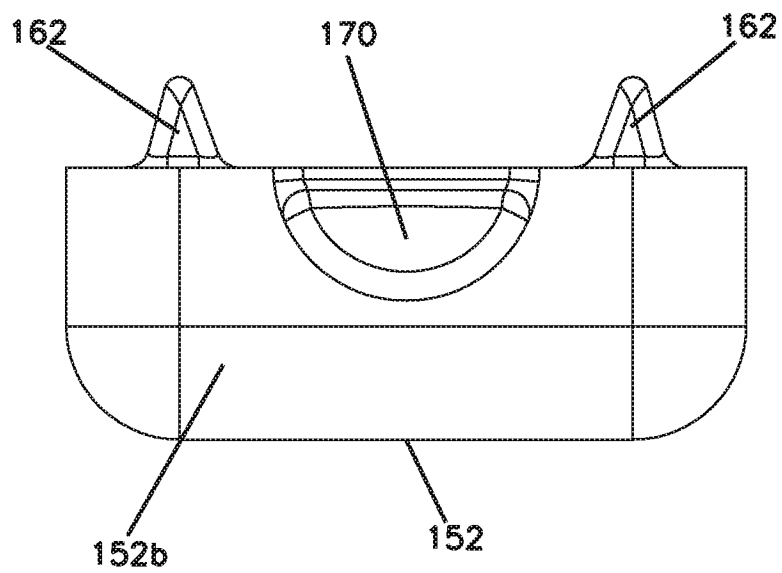


FIG. 39

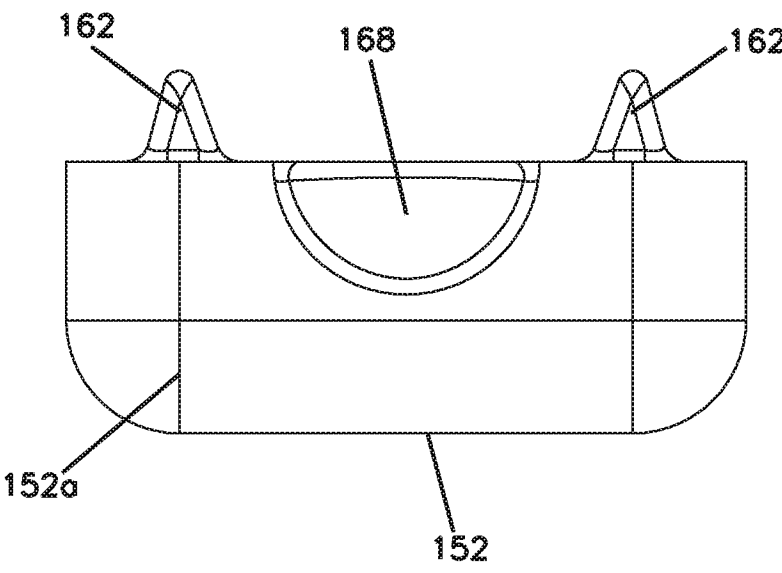


FIG. 40

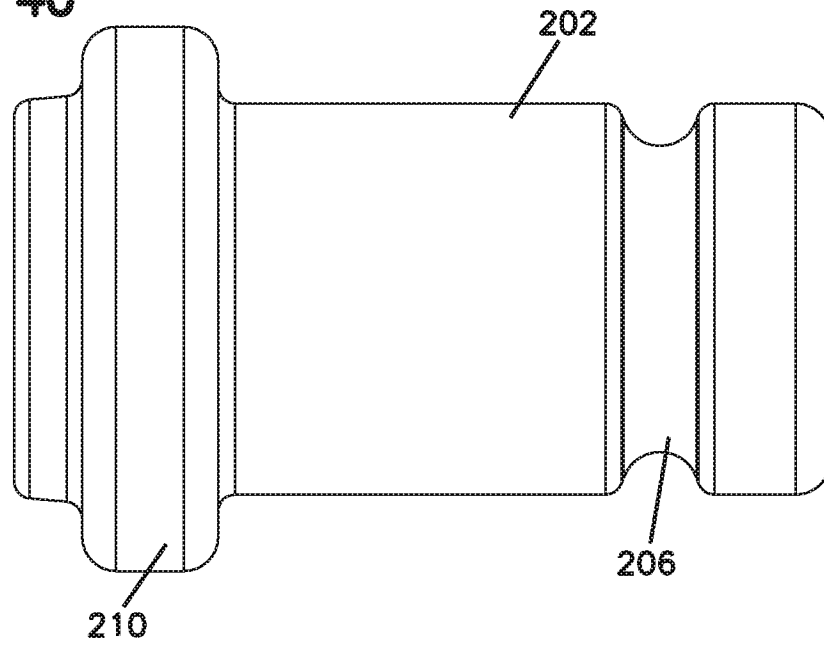


FIG. 41

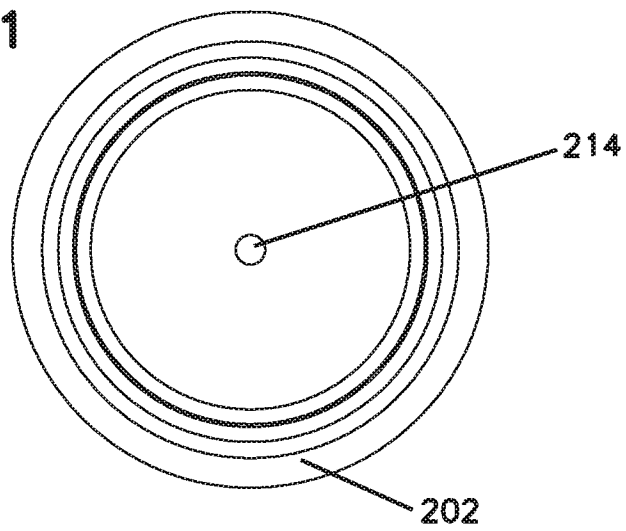


FIG. 42

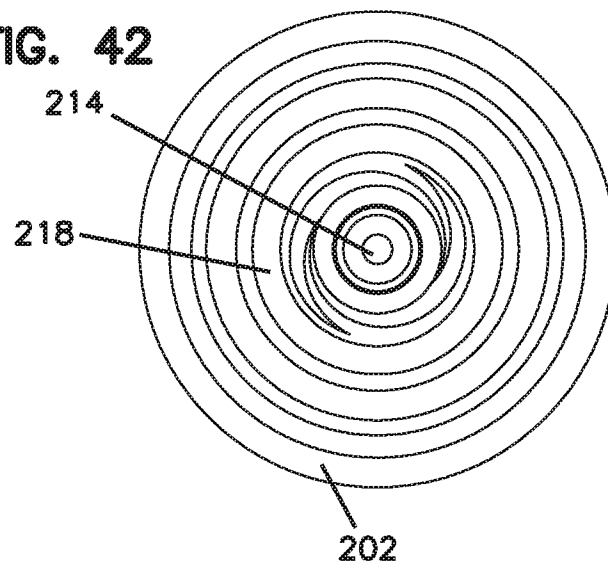


FIG. 43

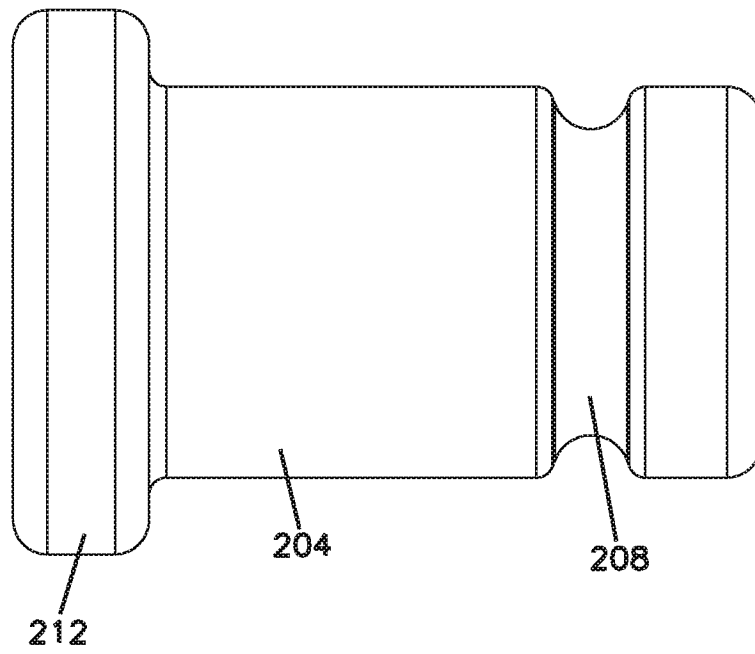


FIG. 44

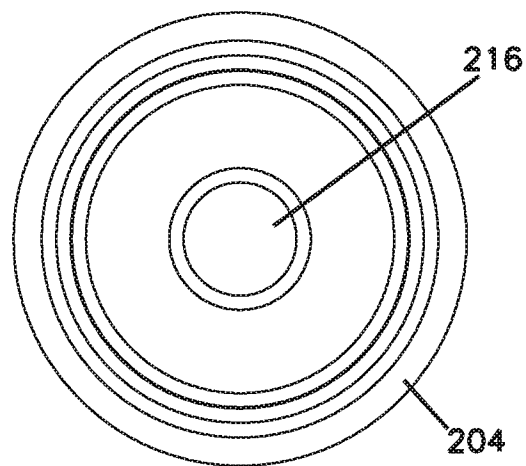


FIG. 45

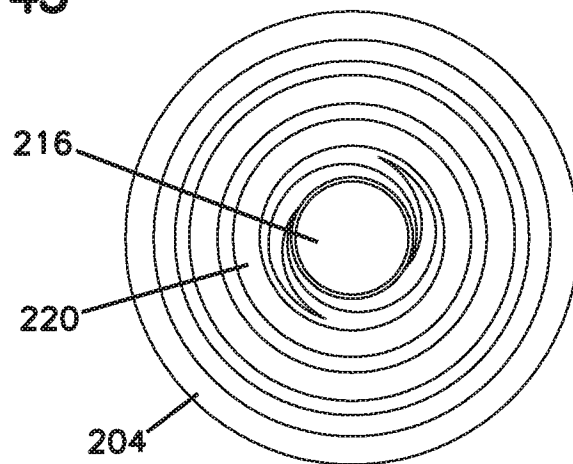


FIG. 46

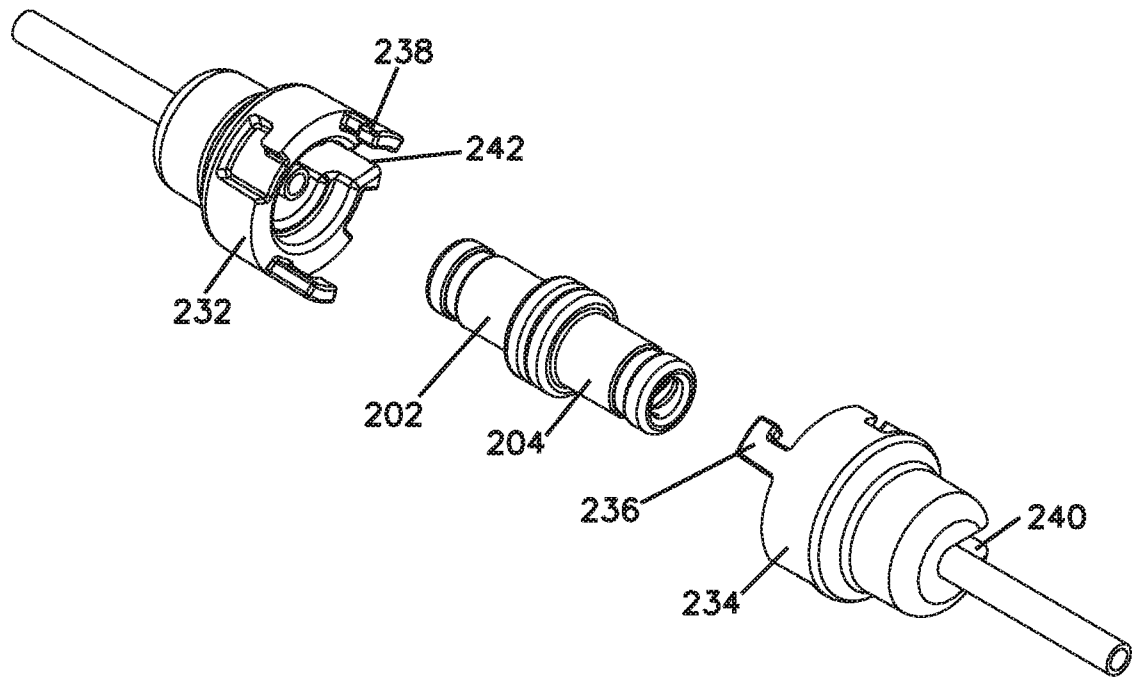
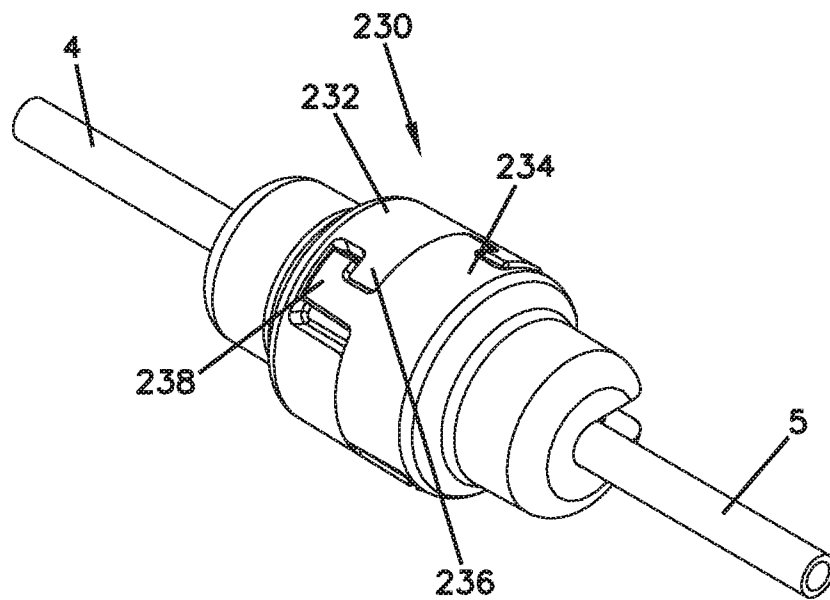


FIG. 47



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/030988**A. CLASSIFICATION OF SUBJECT MATTER****G02B 6/38(2006.01)I, G02B 6/46(2006.01)I**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G02B 6/38; A61B 8/12; B65H 51/16; B60F 3/24; B65H 59/00; G02B 6/46

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: cable blow, conduit, housing, flange, aperture, mate, compressed gas

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6170804 B1 (ALLEN) 09 January 2001 See column 2, line 41 - column 4, line 53 and figures 1-3.	1-7
A		8-20
Y	JP 2005-211582 A (FUJINON SANO K.K.) 11 August 2005 See paragraphs [0016]-[0026] and figures 1-5.	1-7
A	US 6402123 B1 (RIVARD) 11 June 2002 See column 2, line 49 - column 3, line 45 and figure 1.	1-20
A	US 2005-0258410 A1 (ANDREWS) 24 November 2005 See paragraphs [0026]-[0028] and figures 1-2.	1-20
A	US 6311953 B1 (LANG et al.) 06 November 2001 See column 2, line 18 - column 3, line 61 and figures 1-2.	1-20

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

19 August 2016 (19.08.2016)

Date of mailing of the international search report

22 August 2016 (22.08.2016)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

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Authorized officer

KANG, Sung Chul

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2016/030988

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		FR 2807226 B1	09/08/2002
US 2005-0258410 A1	24/11/2005	None	
US 6311953 B1	06/11/2001	AR 023787 A1	04/09/2002
		AT 336816 T	15/09/2006
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